



May 9, 2014

Mr. Tim Drexler  
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U.S. Environmental Protection Agency (EPA) Region 5  
77 W. Jackson Blvd.  
Chicago, IL 60604

**Subject: Sampling Plan for Remedial Action  
Supplemental Remediation, Confirmation Sampling and Clean Fill Sampling,  
Triax Building Area, Plant 2, Outboard Marine Corporation  
Remedial Action Contract (RAC) 2  
Work Assignment No. 167-RARA-0528**

Dear Mr. Drexler:

SulTRAC is submitting the revised enclosed Sampling and Analysis Plan (SAP), which includes the site-specific Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) for impending Remedial Action analysis activities in the Triax Building Area at the above-referenced site in Waukegan, Illinois. The revised documents have been prepared to document required confirmation sampling, waste characterization sampling, and the sampling of clean fill during the supplemental remediation activities.

The documents have been revised to address comments received by SulTRAC on May 5, 2014 in a memorandum dated April 17, 2014.

If you have any questions regarding the documents, please call me at (312) 201-7474.

Sincerely,

A handwritten signature in black ink, appearing to read 'Tom Hahne', with a long, sweeping underline.

Tom Hahne  
SulTRAC Project Manager

Enclosure

cc: Parveen K. Vij, EPA Contracting Officer (letter only)  
J.D. Campbell, Ph.D., P.E., SulTRAC Program Manager (letter only)  
Mindy Gould, SulTRAC (letter only)  
File

**REMEDIAL ACTION CONTRACT 2 FOR  
REMEDIAL, ENFORCEMENT, OVERSIGHT, AND  
NON-TIME-CRITICAL REMOVAL ACTIVITIES  
IN REGION 5**

**SUPPLEMENTAL REMEDIATION  
CONFIRMATION SAMPLING AND CLEAN FILL SAMPLING  
TRIAx BUILDING AREA**

**SAMPLING AND ANALYSIS PLAN FOR  
REMEDIAL ACTION**

**PLANT 2  
OUTBOARD MARINE CORPORATION  
WAUKEGAN, ILLINOIS**

**Prepared for  
U.S. Environmental Protection Agency  
Region 5  
77 West Jackson Boulevard  
Chicago, Illinois 60604-3590**

Date Submitted:	May 9, 2014
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Contract No:	EP-S5-06-02
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**SAMPLING AND ANALYSIS PLAN  
FOR REMEDIAL ACTION  
PLANT 2, OUTBOARD MARINE CORPORATION  
WAUKEGAN, ILLINOIS**

SulTRAC has prepared this Sampling and Analysis Plan (SAP) for Operable Unit (OU) 4 of the Outboard Marine Corporation (OMC) Plant 2 site in Waukegan, Illinois, under the U.S. Environmental Protection Agency (EPA) Remedial Action Contract (RAC) II for Region 5, Contract No. EP-S5-06-02, Work Assignment (WA) No. 167-RARA-0528. Under this WA, confirmation soil samples will be collected to obtain the information necessary to determine if remedial action objectives (RAO) have been met as specified in the Basis of Design (CH2M Hill 2008) and to properly characterize waste before off-site transportation and disposal. The SAP consists of the field sampling plan (FSP) (Attachment A) and the QAPP (Attachment B), which are among the site-specific plans to be prepared under the WA in accordance with Task 1 of the EPA statement of work (SOW) (EPA 2009), as revised in August 2013 (EPA, 2013).

**REMEDIAL ACTION CONTRACT 2  
FOR REMEDIAL, ENFORCEMENT OVERSIGHT, AND  
NON-TIME CRITICAL REMOVAL ACTIVITIES  
IN REGION 5**

**ATTACHMENT A**

**FIELD SAMPLING PLAN  
SUPPLEMENTAL REMEDIATION  
CONFIRMATION SAMPLING**

**TRIAX BUILDING AREA**

**OUTBOARD MARINE PLANT 2 SITE  
WAUKEGAN, ILLINOIS**

**Prepared for  
U.S. Environmental Protection Agency  
Region 5  
77 West Jackson Boulevard  
Chicago, IL 60604**

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## CONTENTS

<b><u>Section</u></b>	<b><u>Page</u></b>
ACRONYMS AND ABBREVIATIONS .....	iii
1.0 INTRODUCTION .....	1
2.0 SITE DESCRIPTION AND HISTORY .....	2
2.1 SITE DESCRIPTION .....	2
2.2 SITE HISTORY .....	2
2.3 OTHER PREVIOUS SITE INVESTIGATIONS .....	3
3.0 PROJECT OBJECTIVES .....	5
4.0 FIELD SAMPLING ACTIVITY .....	6
5.0 FIELD SAMPLING PROCEDURES .....	8
5.1 STAKING AND MARKING EXCAVATION AREA GRIDS .....	8
5.2 UTILITY LOCATING .....	8
5.3 CONFIRMATION SAMPLING .....	8
5.4 WASTE CHARACTERIZATION SAMPLING .....	10
5.5 SURVEYING .....	12
5.6 CLEAN FILL SAMPLING .....	12
6.0 LABORATORY ANALYTICAL METHOD .....	13
7.0 DECONTAMINATION PROCEDURES .....	14
8.0 SAMPLE HANDLING PROCEDURES .....	15
8.1 SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIMES .....	15
8.2 SAMPLE IDENTIFICATION .....	15
8.3 SAMPLE LABELS .....	18
8.4 SAMPLE DOCUMENTATION .....	18
8.5 SAMPLE CHAIN OF CUSTODY .....	19
8.6 SAMPLE PACKING AND SHIPPING .....	20
9.0 DISPOSAL OF INVESTIGATION-DERIVED WASTE .....	22
10.0 HEALTH AND SAFETY PROCEDURES .....	23
11.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS .....	24
12.0 REFERENCES .....	25

## TABLES

<b><u>Table</u></b>	<b><u>Page</u></b>
1 SUMMARY OF FIELD INVESTIGATION ACTIVITIES .....	7
2 SUMMARY SAMPLE INFORMATION FOR OMC SITE .....	11
3 ANALYTICAL METHODS SUMMARY .....	13
4 SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIMES .....	16
5 GENERALIZED SAMPLE IDENTIFICATION SCHEME .....	17

## **FIGURES**

- Figure 1      Site Location
- Figure 2      Remediation Areas
- Figure 3      Confirmation Sampling Grids

## **ATTACHMENT 1**

### **STANDARD OPERATING PROCEDURES**

- SOP 002      General Equipment Decontamination
- SOP 003      Organic Vapor Monitoring
- SOP 005      Soil Sampling
- SOP 024      Recording Notes in Field Logbooks

## ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
COC	Chain of custody
CPAH	Carcinogenic polynuclear aromatic hydrocarbon
DNAPL	Dense non-aqueous phase liquid
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
FSP	Field sampling plan
GIS	Geographic information system
GPS	Global positioning system
HASP	Health and safety plan
ID	Identification
IDW	Investigation-derived waste
mg/kg	Milligrams per kilogram
MS	Matrix spike
MSD	Matrix spike duplicate
NPL	National Priorities List
NSS	New Smelter Slab
OMC	Outboard Marine Corporation
OU	Operable unit
PCB	Polychlorinated biphenyl
PPE	Personal protective equipment
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
RAC	Remedial action contract
RAO	Remedial action objective
RD	Remedial design
RI	Remedial investigation

SAP	Sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act
SMP	Site management plan
SOP	Standard operating procedure
SVOC	semi-volatile organic compound
TCE	Trichloroethene
TSCA	Toxic Substances Control Act
VOC	volatile organic compound
WA	Work assignment



## **1.0 INTRODUCTION**

SulTRAC prepared this field sampling plan (FSP) as part of remediation activities specified in the sampling and analysis plan (SAP) for the Outboard Marine Corporation (OMC) Plant 2 Site in Waukegan, Lake County, Illinois, under U.S. Environmental Protection Agency (EPA) Remedial Action Contract (RAC) 2 for Region 5, Contract No. EP-S5-06-02, Work Assignment (WA) No. 167-RARA-0528. As described in this FSP, confirmation soil samples will be collected to obtain the information necessary to determine if remedial action objectives (RAO) have been met, as specified in the Basis of Design (CH2M Hill 2008). Confirmation sampling will be conducted during remediation activities in Spring and early Summer 2014. The SAP consists of this FSP (Attachment A) and an associated quality assurance project plan (QAPP), which is Attachment B (SulTRAC 2014b). Quality assurance (QA) and quality control (QC) protocols associated with sampling and analysis are consistent with the previously approved site-specific QAPP that was included as part of the CH2M Hill Basis of Design (CH2M Hill 2008).

The primary objective of the soil sampling is to assess compliance with the RAOs as identified in the Basis of Design. This includes the RAOs used to determine the limits of remediation and also the requirements for the import of clean fill. A secondary objective is to characterize concrete for disposal either as Toxic Substances Control Act (TSCA) waste or as non-TSCA waste based on polychlorinated biphenyl (PCB) concentrations.

This FSP describes procedures to complete these activities.

## **2.0 SITE DESCRIPTION AND HISTORY**

This section describes the OMC Plant 2 site, summarizes the site's operational history, and describes previous investigations at the site. A more detailed discussion of site background information is found in the remedial investigation (RI) report (CH2M Hill 2006a).

### **2.1 SITE DESCRIPTION**

Located at 90 East Seahorse Drive in Waukegan, Illinois, about 40 miles north of Chicago, the OMC Plant 2 site is the fourth of four operable units (OU) of the OMC site on the National Priorities List (NPL). The OMC site also includes the Waukegan Harbor site (OU 1), the Waukegan Manufactured Gas and Coke Plant (Waukegan Coke Plant) site (OU 2), and the Polychlorinated Biphenyl (PCB) Containment Cells (OU 3). Figure 1 shows the location of the OMC Plant 2 site.

The site has been largely remediated, and site buildings, slabs, sub-slab soils, and defined remediation areas have been addressed by prior actions. The remaining remediation areas are shown on Figure 2. The major remediation includes the Triax Building and the surrounding area, which includes the Trim Building Slab and the adjacent parking lot and grassy areas. Grid P-33 will also be remediated because it contains residual concrete and TSCA soil (soil contaminated in excess of TSCA standards) below the water table.

### **2.2 SITE HISTORY**

The OMC Plant 2 site includes a 60-acre lakefront parcel that formerly hosted an abandoned 1,060,000-square-foot industrial facility where OMC made outboard motors from about 1948 until 2000. OMC was the world's largest manufacturer and supplier of outboard motors and the second-largest producer of powerboats. The facility used hydraulic and lubricating oils that contained PCBs in its production lines from 1961 until 1972, and routinely discharged some of the fluids via sewer lines into Waukegan Harbor, thereby becoming the source of very high-level PCB contamination in harbor sediment. OMC also operated several vapor degreasers at the OMC Plant 2 facility to clean newly made parts with trichloroethene (TCE). Over the years, leaking degreasers and TCE storage tanks created a plume of TCE in groundwater and a dense non-aqueous phase liquid (DNAPL) plume beneath the OMC Plant 2 site.

OMC declared bankruptcy in December 2000 and ceased all manufacturing operations in August 2001. Much of the OMC site is now owned by the City of Waukegan (the City).

## 2.3 OTHER PREVIOUS SITE INVESTIGATIONS

EPA began the RI at the OMC Plant 2 site in 2004 to delineate the nature and extent of contamination in site groundwater, sediment, soil, and within the OMC Plant 2 building. EPA issued the *Remedial Investigation Report (for) OMC Plant 2*, presenting the study results and a human health and ecological risk assessment in April 2006 (CH2M HILL 2006a). EPA began a feasibility study (FS) in 2005 to examine cleanup alternatives designed to protect human health and the environment, and issued the *Feasibility Study Report (for) OMC Plant 2* in December 2006 (CH2M HILL 2006b).

In early 2006, EPA shared the preliminary RI findings with the City, and the City quickly responded by hiring a contractor to demolish the nearly 400,000 square feet of uncontaminated structures down to the concrete slabs (beginning in August 2006). Metals were reclaimed for recycling, and the remaining debris was hauled off site and disposed of in a licensed municipal waste landfill. The City, by agreement with EPA, moved PCB-containing electrical transformers from this area into a storage room in the contaminated building, and then EPA disposed of them off site. In January 2007, most PCB-containing transformers were disposed of off site at a licensed facility. One large PCB-containing transformer remained on the roof of the contaminated building and was addressed during the final building cleanup action in 2010.

SulTRAC completed asbestos abatement and demolition of the existing buildings in 2010 and 2011. In 2011 and 2012, after the Plant 2 structures had been removed, SulTRAC remediated the former building slabs and subslab soils of Plant 2 and the New Smelter Slab (NSS) building areas. In addition, sediment in the North Ditch was excavated and later covered with a reactive core mat with anchor and armor materials. In 2012, the off-site waterway was dredged in two areas. Soil in the dunes area was remediated and a TSCA-compliant cap was placed over soil adjacent to the east edge of the east containment cell.

SulTRAC conducted supplemental sampling activities in 2011 to delineate the extent of soil contamination within the NSS area, and also within other areas of the site (SulTRAC 2011a). Results of this sampling were referenced to prepare a Supplemental Design (SulTRAC 2011b) that was implemented in 2011 and completed in early 2012.

As part of remediation activities, confirmation samples were collected from the base and sidewalls of each 50- by 50-foot grid in the West Shelf Area. Results of this confirmation sampling indicated the presence of PCB contamination beyond the scope of the remedial design (RD). Contamination extended south of the NSS within the area bounded by previously excavated Areas 7, 12, 13, 10, and the Trim Building Slab.

SulTRAC performed a supplemental investigation in the West Shelf Area to identify the extent of contamination requiring remediation. Samples were collected on a 50-foot grid pattern and at 1-foot depth intervals to establish whether soils met RAOs. The results were presented in a technical memorandum (SulTRAC 2012) and used to develop the Supplemental Design for the West Shelf, East Shelf, and Grid LL-33 areas (SulTRAC 2013b). Supplemental remediation was conducted in the Summer of 2013, which included the removal of soil and concrete to meet RAO within Grid LL-33, the East Shelf, and West Shelf. A substantial concrete structure was encountered in Grid P-33 that is underlain by TSCA soil. This area was not remediated.

SulTRAC conducted confirmation sampling of sidewalls on the west side of the remediation area and additional investigation to the west, including the Triax Building Area, Trim Building Slab, and Grid PP-33 to identify additional soil contamination exceeding RAOs (SulTRAC 2013e). A supplemental design was prepared by SulTRAC (2014a) to address residual soil contamination and concrete in Grid P-33. This FSP (Attachment to the SAP) has been prepared for the confirmation sampling of previously unsampled grids in the Triax Building Area, Grid P-33 waste characterization sampling and sampling of clean fill to be conducted during the supplemental remediation.

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### **3.0 PROJECT OBJECTIVES**

This FSP describes the approach to be followed during confirmation soil sampling at the OMC Plant 2 site.

The three project objectives are as follows: (1) to conduct confirmation sampling in grids that were not accessible for supplemental sampling to determine the limits of excavation and where soil exceeding the TSCA criterion of 50 mg/kg total PCBs is present at the deepest sampled depth; (2) to sample the Triax Building Slab and subslab soils to determine whether concrete and soil meets remedial action objectives; (3) to characterize concrete from Grid P-33 for proper transportation and off-site disposal; and (4) to sample clean fill material before it is transported to the site.

All SulTRAC field activities will be performed in accordance with this FSP, the site-specific QAPP (Attachment B), and SulTRAC's standard operating procedures (SOP) found in Attachment 1.

## **4.0 FIELD SAMPLING ACTIVITY**

This section addresses the proposed field investigation activities and the rationale for conducting these activities. A detailed discussion of sample collection procedures appears in Section 5.0. Field sampling activities discussed in this section pertain to all proposed soil and concrete sampling. Figure 2 shows the remediation areas that will require confirmation sampling or sampling for waste disposal characteristics, and Figure 3 shows the specific grids where confirmation sampling will be needed. Table 1 summarizes each activity to be conducted and its purpose.

Before confirmation sampling begins, preliminary work will be conducted to direct sampling and to modify proposed sampling locations, as appropriate. Preliminary field activities will include marking the 50- by 50-foot excavation grid areas. A hydraulic push probe equipped with a Macropore (or equivalent) sampler will be used to sample soils prior to excavation. Where concrete slab is present, concrete coring will be used to exposed underlying soils before soil sampling. Sampling will be conducted to evaluate whether the soil exceeds the 1 milligram per kilogram (mg/kg) RAO for total PCBs. Where oily soil is exposed and data is not available from supplemental sampling, confirmation sampling must also meet the 2 mg/kg RAO for carcinogenic polynuclear aromatic hydrocarbons (CPAH); finally, where soil is present that has a strong odor or evidence of volatile organic compounds (VOC), sampling may be conducted to ensure that RAOs for VOCs are met.

In the Triax Building Area, soil will be excavated within 50- by 50-foot grids where previous confirmation sampling results have not met RAOs. Within each contaminated grid area, soil will be removed to a predetermined depth or (where data is not available) removed in 1-foot increments then new confirmation samples will be collected from the base of each grid. Results will be provided within 72 hours of collection, and additional removal will be completed in 1-foot increments, if required. The soil will be excavated within the Triax Building Area until the RAOs are met or the water table is encountered.

In Grid PP-33, concrete samples will be collected from the slab once it is removed. If the concrete material exceeds TSCA criteria of 50 mg/kg, confirmation samples of residual soil will be collected from the base of the grid. No additional confirmation samples will be required from this grid because sufficient data are available to characterize and remove remaining contaminated soils.

Table 1 summarizes the proposed sampling activities, and associated sampling locations and purposes of sampling.

**TABLE 1**  
**SUMMARY OF FIELD INVESTIGATION ACTIVITIES**

<b>Proposed Activity</b>	<b>Locations or Areas</b>	<b>Purpose</b>
Staking or marking	50- by 50-foot excavation grid lines and excavation area boundaries as shown on Figure 3.	Establish sampling grids for excavation.
PCB confirmation sampling – base sampling	At center of base of 50- by 50-foot excavation grid, in grids where prior sample data that meets remediation objectives are not available or where prior confirmation sample data exceeded RAOs.	Collect soil samples to determine whether RAO for PCBs has been met.
PCB confirmation sampling – hydraulic push probe sampling	At center of base of 50- by 50-foot excavation grids as identified in Figure 3	Collect soil samples to determine whether RAO for PCBs has been met
PCB confirmation sampling – concrete cores	Triax Building Subslab Grids. At center of 50- by 50-foot excavation grids as identified in Figure 3.	Collect concrete samples to determine whether RAO for PCBs has been met.
CPAH confirmation sampling	Samples will be collected from grids where evidence of oily material is encountered during confirmation sampling.	Collect soil samples to determine whether RAO of 2 mg/kg CPAHs has been met.
VOC confirmation sampling	Where evidence of contamination consistent with VOCs is observed, samples for VOCs will be collected as grab samples.	Determine if the RAO for TCE of 12 mg/kg is met.
TSCA characteristic sampling	Excavated concrete from Grid PP-33.*	Determine whether material is TSCA-regulated waste based on PCB concentrations.
Clean fill sampling	Sample clean fill source material at sources (to be determined). Obtain samples from each source and type of fill material.	To determine whether fill is acceptable for use as clean fill at the site.
Survey	Each excavation grid sampling location.	Generate data to show sampling locations on existing site maps

Notes:

\* Confirmation sampling of residual soil from the base of the grid will be required if concrete sample results exceed TSCA criteria for PCBs.

CPAH Carcinogenic polynuclear aromatic hydrocarbon  
PCB Polychlorinated biphenyl  
RAO Remedial action objective  
TCE Trichloroethylene  
TSCA Toxic Substances Control Act  
VOC Volatile organic compounds

## **5.0 FIELD SAMPLING PROCEDURES**

This section describes the procedures and methods to be used to collect the soil and concrete samples described in Section 4.0.

### **5.1 STAKING AND MARKING EXCAVATION AREA GRIDS**

A sampling grid will be established with approximately 50-foot spacing that is tied to the defined remediation areas.

### **5.2 UTILITY LOCATING**

Utilities will be located and marked prior to initiating confirmation sampling activities.

### **5.3 CONFIRMATION SAMPLING**

Composite soil samples will be collected either using a hydraulic push probe or from the base of excavation areas for PCB analysis where data is not available from prior sampling.

A hydraulic push probe will be used to sample from soil surface to a depth of 5 feet bgs or from the depth interval as shown on Figure 3 (for example where TT-22 requires sampling only from 5 to 7 feet bgs).

Continuous soil samples will be taken and each 1-foot interval will be submitted for PCB analysis. Soil samples will be obtained using dedicated acetate sleeves using a Macropore (or equivalent) sampler. The depth of each boring will be extended to minimum of 5 feet bgs at which point the boring will be terminated if groundwater is encountered. If groundwater is not encountered, the boring will be extended to the groundwater interface and sampled in 1 foot increments.

Where concrete is present, concrete will be cored to sample underlying soils. At locations within the Triax Building, samples will be retained from each location of concrete material. The concrete will first be broken into small fragments on a clean surface and then placed in an appropriate container.

If physical evidence of oily material is observed during confirmation soil sampling, samples will also be collected and analyzed for CPAHs.

If evidence of volatile organic contamination is observed either as odor, staining, or by elevated photoionization detector (PID) readings, samples will be also be collected and analyzed for VOCs. SOP-003 in Attachment 1 provides the methodology for measuring organic vapors using a PID.



The site-specific RAOs for PCBs, CPAHs, and TCE are 1 mg/kg , 2 mg/kg, and 12 mg/kg respectively; (SulTRAC 2014). Confirmation and soil characteristic sampling procedures are provided in SOP 005 in Attachment 1. All samples will be collected by personnel wearing non-powdered nitrile gloves.

*Composite Sample Collection* - Composite soil samples will be collected by dividing the base into quadrants and collecting equal-volume subsamples from a minimum of four locations representative of soil conditions. Subsamples will be collected using a dedicated spoon. The subsamples will then be mixed in a dedicated, clean container to form the composite sample. Sampling will be documented in a logbook as specified in SOP 024 (see Attachment 1)).

*Grab Sample Collection* – For VOCs, soil samples will be collected in accordance with SulTRAC SOP 005 (see Attachment 1) and shipped to the subcontracted laboratory for VOC analysis. Sampling will be documented in a logbook (see SOP 024 in Attachment 1).

*Concrete Sample Collection* – Concrete core samples will be collected from the Triax Building Subslab. Core samples will include a composite of material from the upper, middle, and lower portion of each core. Prior to containerization samples will be broken into smaller fragments on a hard clean surface using a pre-cleaned weight or hammer, but will not be pulverized in the field. A larger (12 ounce) jar will be used to collect sufficient volume to allow for a representative sample. The laboratory will pulverize samples for analysis. Concrete samples from four Triax Building locations will be submitted for PCB analysis. Other concrete cores will be retained for potential future analyses.

The following information will be included in the logbook for each sample: site name, project name, grid number, sample type, date collected, sampler's name or initials, and location sketch (with adequate information to find the sample location(s) if warranted) with a north directional arrow. Each confirmation sample will be labeled with the grid coordinate followed by B (for base) or S (for sidewall), and depth for the base sample or depth interval for a sample collected using a hydraulic push probe. If a sidewall is re-excavated, the sample will have an additional suffix—R-1 through R-N (for resample number). If a base is resampled, only the designator for the depth of the sample will be changed. Soil samples collected will be analyzed for PCBs, CPAHs, and VOCs using the analytical methods specified in Section 6.0. Sample container, preservation, and holding time requirements are discussed in Section 8.1. Soil samples will be collected in accordance with SOP 005 in Attachment 1. Table 2 summarizes the anticipated confirmation samples.

All waste derived from sampling will be included with remediation waste for disposal. Decontamination procedures and disposal of investigation-derived waste (IDW) are further discussed in Sections 7.0 and 9.0, and in SOP 002 (Attachment 1).

#### **5.4 WASTE CHARACTERIZATION SAMPLING**

The concrete removed from Grid PP-33 will be sampled to determine if it is contaminated with PCBs that exceed the TSCA regulatory level of 50 mg/kg. A representative portion of the concrete will be collected and submitted to the laboratory for analysis. Prior to containerization, the sample will be broken into small fragments on a clean hard surface using a pre-cleaned steel hammer or weight. The sample will be containerized in a 12 ounce jar and further processed at the receiving laboratory. A duplicate sample and matrix spike (MS)/matrix spike duplicate (MSD) sample will also be collected. The number and types of samples are listed in Table 2.

In addition, prior to excavation, the subcontractor will collect soil samples to characterize the soil for disposal at an off-site RCRA Subtitle D Landfill. This FSP does not address waste profile sampling and analyses to be conducted by the subcontractor. Plans describing the number of samples, collection methods, target analytes, and analytical methods will be submitted by the subcontractor in accordance with specifications for these activities.

**TABLE 2**  
**SUMMARY SAMPLE INFORMATION FOR OMC SITE**

Sampling Activity (Matrix)	Field Parameter	No. of Grids	No. of Samples	No. of Duplicates <sup>1</sup>	No. of Equipment Blanks <sup>2</sup>	No. of MS/MSD <sup>3</sup>	Total
Confirmation sampling (soil)	PCBs	21	5 per grid	11	0	6	125
Confirmation Sampling (concrete)	PCBs	4	1 per grid	1	0	1	6
Confirmation sampling (soil)	CPAHs <sup>4</sup>	8	1	1	0	1	10
Confirmation sampling (soil)	VOCs <sup>5</sup>	8	2	2	0	1	19
Characteristic testing (concrete)	PCBs	1	1	0	0	0	1
Clean Fill Sampling	VOCs, SVOCs, , Metals, Cyanide, Pesticides, PCB, and Soil pH	NA	6	1	0	1	8

Notes:

- <sup>1</sup> Duplicate samples are collected at a rate of 1 per 10 investigative samples of the same matrix.
- <sup>2</sup> Equipment blanks will not be collected because dedicated or disposable equipment will be used.
- <sup>3</sup> MS/MSD samples are included in the total. MS/MSD samples are collected at a rate of 1 per 20 investigative samples of the same matrix.
- <sup>4</sup> Sample numbers include only grab samples to be collected if evidence of oily material is encountered during confirmation sampling.
- <sup>5</sup> Sample numbers include only grab samples to be collected if evidence of VOCs is encountered during confirmation sampling.

CPAH      Carcinogenic polynuclear aromatic hydrocarbon  
MS        Matrix spike  
MSD      Matrix spike duplicate  
OMC      Outboard Marine Corporation  
PCB      Polychlorinated biphenyl  
SVOC     Semivolatile organic compounds  
VOC      Volatile organic compounds

## **5.5 SURVEYING**

After the samples are collected, SulTRAC will document the approximate locations of each sample using a global positioning system (GPS) or traditional surveying equipment.. Alternatively, if locations were pre-surveyed by a licensed surveyor, the locations will be recorded by grid location only.

If a GPS unit is used, a Trimble GeoXT hand-held GPS unit with an accuracy of less than 1 meter will be utilized in the field for data acquisition. Trimble's GPS Correct Software has been preloaded on these units to ensure differential correction of data captured, as has the Terrasync software that will reference basemap features such as aerial photography, utilities, and parcel boundaries acquired before field activities begin. Before field activities begin, SulTRAC will load these geographic information system (GIS) layers or other data onto the GPS units for use by the field team. The sample location coordinates will be stored and retained for transfer to a database in order to identify the physical location of each boring. The GPS data will be retained for use on future diagrams and for integration into a site database.

## **5.6 CLEAN FILL SAMPLING**

Clean fill will be sampled at each off-site source. Fill materials to be sampled will include topsoil, earth fill, and sand. A minimum of two composite samples will be collected from each identified source for each type of fill material. Thus, a minimum of 6 fill material samples may be collected. These samples will be collected as composite samples from stockpiled fill material. A minimum of two samples will be collected for the first 3,000 cubic yards of material and an additional sample will be collected for each incremental 3,000 cubic yards for each fill source. The stockpile will be separated into approximately equal areas and material will be collected and composited in the same manner as described in Section 5.3 for confirmation sampling. This method will be used for the non-volatile organic compound fractions.

The VOC fraction will be collected as grab samples to prevent potential volatilization. Each subsample location will be assessed with a PID and the two locations with the highest PID reading will be used for collecting the grab sample. These samples will be collected in accordance with SOP 5. Each fill source will be labeled to identify the fill location (address) and fill type (sand, topsoil, or earth fill). Samples will be analyzed for Target Compound List (TCL) compounds including VOCs, semivolatile organic compounds (SVOC), metals, cyanide, pesticides, PCBs, and soil pH. The analytical results will be evaluated against the project required action limits as specified in Worksheet 15 of the attached QAPP.

## 6.0 LABORATORY ANALYTICAL METHOD

Table 3 presents the laboratory methods for analyzing the soil and concrete samples collected by SulTRAC. Field investigation samples will be analyzed by a subcontractor laboratory.

**TABLE 3**  
**ANALYTICAL METHODS SUMMARY**

Parameter	Analytical Method
<b>SOIL/CONCRETE</b>	
PCBs	SW-846 Method 8082A
CPAHs	SW-846 Method 8270D
VOCs	SW-846 Method 8260B
SVOCs	SW-846 Method 8270D
Pesticides and Herbicides	SW-846 Method 8081A
Metals (except mercury)	SW-846 Method 6020A
Mercury	SW-846 Method 7471A
Cyanide	SW-846 9012A
Soil pH	SW-9045D

Note:

CPAH Carcinogenic polynuclear aromatic hydrocarbon  
PCB Polychlorinated biphenyl  
SVOCs Semivolatile organic compounds  
VOCs Volatile organic compounds

## **7.0 DECONTAMINATION PROCEDURES**

During sampling, SulTRAC will follow the decontamination procedures for soil and concrete sampling as outlined below.

To prevent cross-contamination, measuring and sampling equipment will be decontaminated before sample collection begins and after sampling at each location. The equipment will be decontaminated following the general practices in SOP 002 (Attachment 1), or as identified below.

When stainless steel bowls and spoons are used for sample handling, a separate set will be dedicated to each sample to eliminate potential cross-contamination between samples. In lieu of stainless steel sampling equipment, disposable sampling equipment may be used to collect grab or composite samples. Decontamination of disposable sampling equipment will not be required.

## **8.0 SAMPLE HANDLING PROCEDURES**

SulTRAC will collect soil and concrete samples, prepare the samples for shipment, and complete all necessary documentation. Sample containers, preservatives, holding times, identification, documentation, chain of custody (COC), packaging, and shipping are discussed in this section.

### **8.1 SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIMES**

SulTRAC anticipates collecting soil and concrete samples for PCB analysis. Sample handling procedures are summarized in Table 4.

### **8.2 SAMPLE IDENTIFICATION**

Samples will be identified by a unique sample identification number (see Table 5). The identifier for the grab samples collected at each grid point will include the following information:

- Site name (OMC)
- Sample location grid node designation (AA13 to represent row AA, column 13)
- Sample media (S for soil and C for concrete)
- Sample type (S for sidewall and B for Base)
- For sidewall samples, wall direction (north, south, east, or west)
- Sample depth for base confirmation samples collected using a hydraulic push probe the depth interval will be used.
- For sidewall samples, add suffix “R” for resample, followed by the resample event (1 for first, 2 for second, and so on—for example, AA-13-S-S-W-R-2 would be a west sidewall soil sample from grid AA-13 after the second sidewall re-excavation event)
- QA/QC designations (D for field duplicate). Note that for MS/MSD samples, no identifier is assigned to the sample number because the MS/MSD is designated only on the COC form.

For fill materials, the sample will be labeled to identify the source by name or address, the type of material and the number (1, 2, etc.) of the sample collected. For example:

- XLFarms-Topsoil-1 (designates the name of the property, the type of fill material, and the first sample).

**TABLE 4**  
**SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIMES**

Matrix	Analyte	Sample Container	Preservation Requirements	Maximum Holding Time (preparation/analysis) <sup>1</sup>
Soil	PCBs	One 4-ounce, wide-mouth glass jar	Cool to 4 ±2°C immediately after collection	14 days to extraction 40 days for analysis
Concrete	PCBs	One 12-ounce, wide-mouth glass jar	Cool to 4 ±2°C immediately after collection	14 days to extraction 40 days for analysis
Soil	CPAHs	One 4-ounce, wide-mouth glass jar	Cool to 4 ±2°C immediately after collection	14 days to extraction 40 days for analysis
Soil	VOC	Two VOA vials with sodium bisulfate preservative (pre weighed) and one VOA vial with methanol preservative (pre weighed)	Cool to 4 ±2°C immediately after collection	14 days for analysis.
Soil	SVOC	One 4-ounce, wide-mouth glass jar	Cool to 4 ±2°C immediately after collection	14 days to extraction 40 days for analysis
Soil	Metals and Cyanide	One 4-ounce, wide-mouth glass jar	Cool to 4 ±2°C immediately after collection	14 days to extraction 180 days for analysis (except 30 days for mercury, 14 days for cyanide)
Soil	Pesticides	One 4-ounce, wide-mouth glass jar	Cool to 4 ±2°C immediately after collection	14 days to extraction 40 days to analysis
Soil	Soil pH	One 4-ounce, wide-mouth glass jar	Cool to 4 ±2°C immediately after collection	Not specified.

Notes:

°C       Degrees Celsius  
CPAH    Carcinogenic polynuclear aromatic hydrocarbon  
PCB     Polychlorinated biphenyl  
SVOC    Semivolatile organic compounds  
VOA     Volatile organic analysis  
VOC     Volatile organic compound

<sup>1</sup> Holding time is measured from time of sample collection to the time of sample extraction and analysis



**TABLE 5**  
**GENERALIZED SAMPLE IDENTIFICATION SCHEME**

Site Name	Sampling Event	Sample Location	Depth in Feet	Sample Type	Example Identification	Notes
OMC	Confirmation sampling soil using hydraulic push probe	Grid AA13	3-4 feet	Soil	OMC-AA13-3-4	All sample locations will have a distinct sample ID, corresponding to the Grid Location and Depth.
OMC	Confirmation sampling, base sample	Grid AA13	4 feet	Soil	OMC-AA13-B-4	All sample locations will have a distinct sample ID, corresponding to the Grid Location and Depth.
OMC	Confirmation sampling, concrete core sample	Grid AA13	NA	Concrete	OMC-AA13-CON	None.
OMC	Waste characterization	Grid PP-33	NA	Concrete	OMC-PP-33-Concrete	None.
OMC	Fill Material	XL Farms	NA	Topsoil	XL-Farms-Topsoil-1	Samples will be numbered incrementally based on number collected.

Notes:

ID Identification  
NA Not applicable  
OMC Outboard Marine Corporation

### **8.3 SAMPLE LABELS**

A sample label will be affixed to all sample containers. Because the laboratory is subcontracted, contract laboratory program (CLP) labeling protocol will not be used. The label will be completed with the following information:

- Project number
- Sample station name (the sample identification [ID] discussed above)
- Sample collection date and time
- Preservative
- Sample collector's initials
- Analysis
- Sample tag number.

After it has been labeled, each sample will be preserved as required (see Table 4).

### **8.4 SAMPLE DOCUMENTATION**

Sampling will be documented in a logbook using indelible ink as specified in SOP 024 (Attachment 1). The header of each page will include the site location name, date, and project number. At the start of each day, the weather, site condition, field staff present, subcontractors present, and any conducted safety or other meeting shall be noted. The collection time, sample identification number, sample depth (if appropriate), sample location description, field observations, sampler's name, and time of sample collection will be recorded in the logbook for each sample. MS/MSD and duplicate samples will be clearly designated in the logbook. Collection of rinsate blank samples is not anticipated.

Each page of the logbook will be dated, numbered (if appropriate), and signed at the bottom by SulTRAC personnel. Any residual space on the last page of each day's logbook entry will be crossed out with a single line. Each new sampling day will begin on a new page in the logbook. Any corrections made during the day of sampling should be crossed out with one single line, or the term "backnote" can be inserted to account for missed time.

The resident inspector ensures that all documentation in the logbook is done appropriately, and accordingly, should check this documentation daily. Any corrections or additions can be made with appropriate documentation, although this procedure is not recommended, and corrections or additions should be made on the day of the documented sampling, if possible.

All field logbooks must be kept secure at all times by the resident inspector while field work is in progress. All completed field logbooks and any hard copies will be stored with the project manager. Field data records will be maintained in accordance with the *Multi-Media Investigation Manual* (EPA 1992) and SulTRAC's QAPP (SulTRAC 2013a).

## 8.5 SAMPLE CHAIN OF CUSTODY

SulTRAC will use standard sample custody procedures to maintain and document sample integrity during collection, transport, storage, and analysis in accordance with the SulTRAC RAC II Contract Level QAPP (SulTRAC 2005). A sample will be considered in custody if one of the following statements applies:

- It is in a person's physical possession or view.
- It is in a secure area with restricted access.
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

The laboratory copy of the COC form will be sealed inside the lid of the cooler. COC procedures provide an accurate written record that traces possession of individual samples from the time of collection in the field to the time of acceptance at the laboratory. One COC record will be generated for each cooler shipped. The COC record also will be used to document all samples collected and the analysis requested.

The following information will be documented on the COC form:

- Project name and number
- Sample numbers
- Sample tag numbers (if applicable)
- Sampling location (station identification)
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample ID number
- Date and time of collection
- Number and type of containers filled
- Analysis requested
- Preservatives used (if applicable)
- Sample designation (grab or composite)

- Special instructions (for example, the laboratory needs to sub-sample oversized material or perform additional homogenization)
- Signatures of all samplers
- Signatures of individuals involved in custody transfer, including date and time of transfer
- Airbill number (if applicable)
- Project contact and phone number
- Custody seal number.

SulTRAC will appoint one of its field technical staff members to serve as the sample custodian. The custodian will also confirm that all descriptive information is complete on the COC forms to be included with each shipping container. Two custody seals will be used: one placed across the latch of the container, and the other affixed on the opposite side of the container lid. The lid will be securely taped shut for shipment.

## **8.6 SAMPLE PACKING AND SHIPPING**

The following procedures will be implemented when samples collected during this project are shipped:

- All sample jars will be wrapped with bubble wrap or other packing material and placed in individual Ziploc-type bags.
- Ice will be placed in the cooler within a large plastic bag. If the cooler has a drain, it will be taped shut both inside and outside of the cooler.
- The cooler will be lined with bubble wrap or other packing material, and all individually packaged samples will be placed into the large plastic bag with the ice and will be tied after all sample jars have been put in. Sufficient packing material will be used to prevent sample containers from breaking during shipment.
- Enough ice will be added to maintain a sample temperature of  $4 \pm 2$  degrees Celsius ( $^{\circ}\text{C}$ ). SulTRAC will prepare, label, and place a temperature blank in each cooler.
- The laboratory should be notified if a sampler suspects that any sample contains anomalously high or low concentrations (hand-write this anomaly directly on the laboratory copy of the COC), or if a sampled substance would require laboratory personnel to take safety precautions.
- The COC specific to each cooler will be sealed inside a plastic bag and taped to the inside of the cooler lid. The COC will be signed by all samplers and the custody seal numbers will be included on the COC. A return pre-paid air bill will be included with the COC so the cooler may be returned to SulTRAC.
- The cooler will be closed and taped shut with strapping tape around both ends.
- Signed and dated custody seals will be placed on the front and side of each cooler. Wide clear tape will be placed over the seals to prevent accidental tearing.
- The air bill, if required, will be completed before the samples are relinquished to the carrier.

- The COC will be transported within the taped sealed cooler. When the cooler is received at the analytical laboratory, laboratory personnel will open the cooler and sign the COCs to document transfer of samples.
- All shipping containers will be labeled as required by the U.S. Department of Transportation (DOT).

## **9.0 DISPOSAL OF INVESTIGATION-DERIVED WASTE**

IDW is waste generated from any activity performed to determine the nature and extent of contamination at the OMC site. IDW may include solid and any hazardous waste, media (soil and concrete), and debris. Contaminants in any IDW will be identified based on sample results, and the IDW will subsequently be managed with the concrete slab and soil remediation waste in accordance with EPA's Guide to Management of Investigation-Derived Waste (EPA 1992a)

<http://www.epa.gov/superfund/policy/remedy/pdfs/93-45303fs-s.pdf>

Additional IDW generated as a result of sampling will include disposable personal protective equipment (PPE), disposable sampling equipment, as well as general refuse such as empty equipment boxes and other packaging. Disposable PPE, sampling equipment, and general refuse will be managed according to the level of contamination encountered during field activities. In general, PPE will be managed as nonhazardous solid waste, particularly if little contact occurs with the sample medium and low levels of contaminants are involved.

## **10.0 HEALTH AND SAFETY PROCEDURES**

All field activities will be conducted in accordance with the SulTRAC Health and Safety Plan (HASP), which is among the site-specific plans prepared for the WA (SulTRAC 2013c). Before field activities begin, all SulTRAC field personnel and subcontractors will read and sign the HASP, indicating that they understand the plan and agree to operate in accordance with its requirements. Daily tailgate meetings will be conducted to review daily activities and task-specific hazards. All SulTRAC personnel and subcontractors must have 40-hour hazardous waste and emergency response training, and proof of certification must be filed with the signed HASP. A complete copy of the site-specific plans, including the HASP, will be maintained by the field sampling team at the site.

## **11.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS**

All QA activities will be conducted in accordance with the SAP, which includes this FSP as well as the QAPP. A copy of the SAP will be maintained by the field sampling team for immediate use in resolving any QA issues that might arise during field activities.

QC samples will be collected at the following frequencies:

- Field Duplicate: One duplicate per 10 environmental samples, with a minimum of one per sample matrix.
- MS/MSD Samples: One sample per 20 environmental samples per matrix
- Rinsate Blank Samples: One sample per week of sampling will be collected to verify quality of decontamination procedures, if necessary. Rinsate blanks will not be collected during this sampling event because disposable sampling equipment will be used. For composite sampling, one set of disposable spoon and disposable bowl per sample will be used to eliminate need for decontaminating equipment and the possibility of cross-contamination.

Field duplicate samples consist of two separate samples collected from the same sampling location and depth, using the same equipment and sampling procedures. The required four aliquots will be collected and mixed in a bowl and the duplicate sample will be collected from the mixed/composited sample material. A rinsate blank sample is collected by accumulating analyte-free water that has been run over/through sample collection equipment. These samples are used to determine if contaminants have been introduced by contact of the sample medium with sampling equipment. As stated above, rinsate blanks will not be collected during this sampling event because disposable sampling equipment will likely be used. MS/MSD samples are environmental samples divided into two separate aliquots, each of which is spiked with known concentrations of target aliquots. The two spiked aliquots, in addition to an unspiked sample aliquot, are analyzed separately, and the results are compared to determine the effects of the matrix on the precision and accuracy of the analysis. For solid matrices, the MS/MSD sample requires extra volume collection, and all MS/MSD samples should be identified as such on the COC form for the designated laboratory.

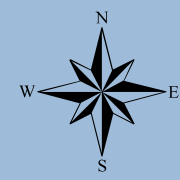
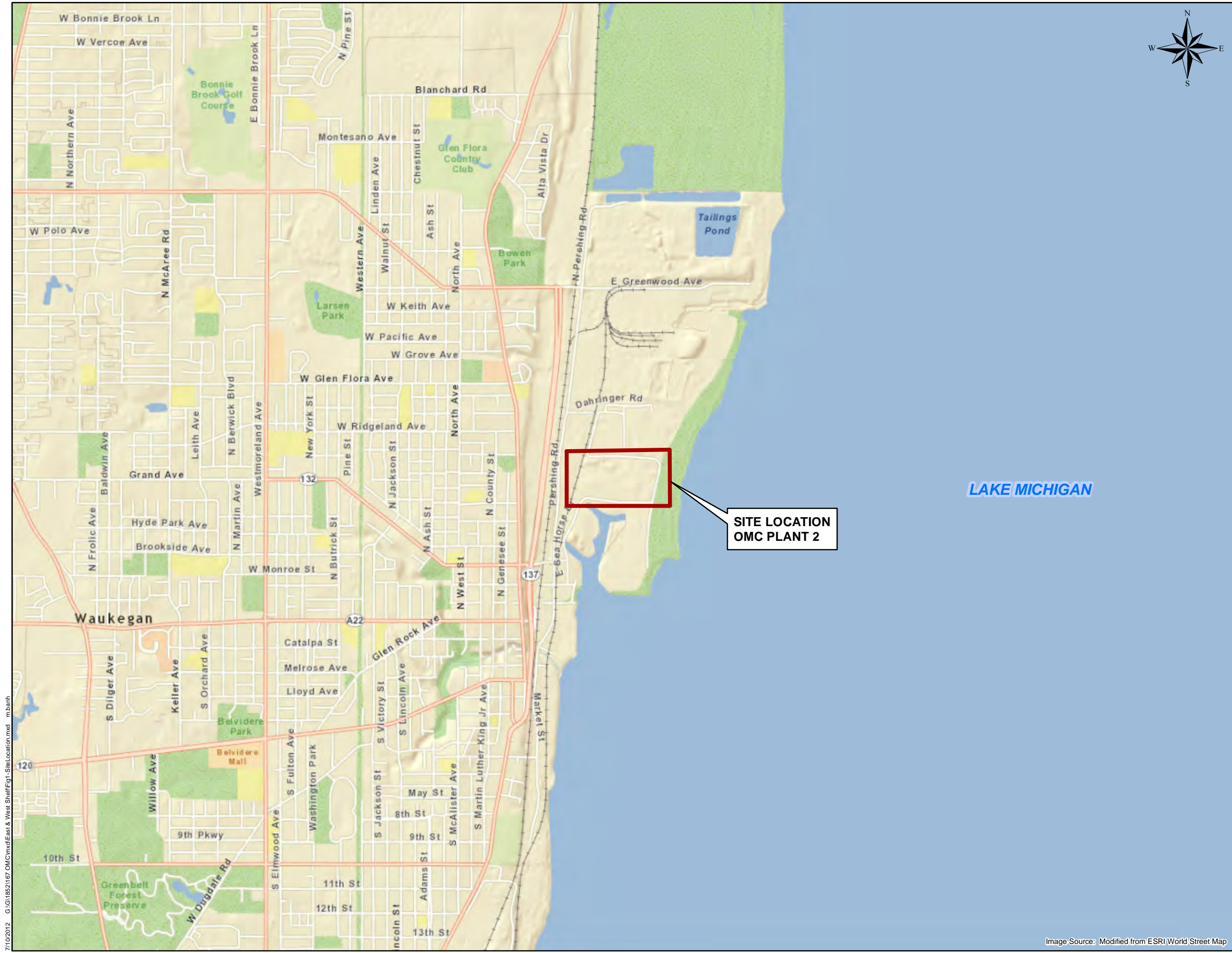


## 12.0 REFERENCES

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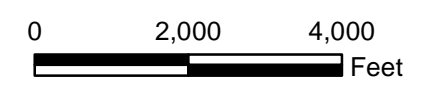
## **FIGURES**

(Three Sheets)



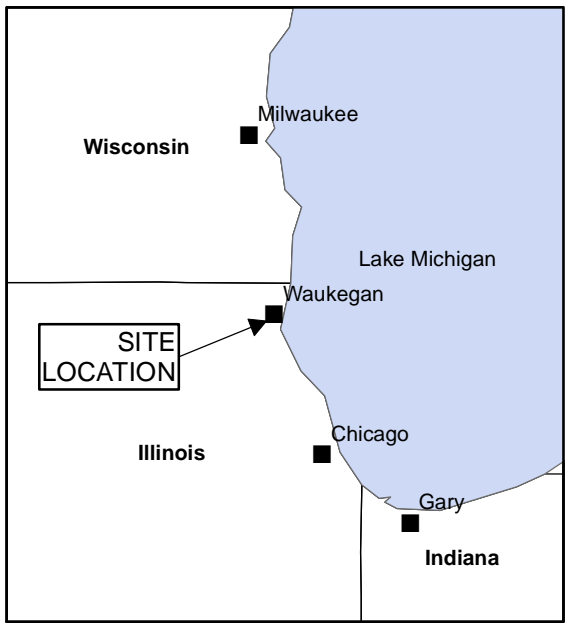
**LEGEND**

 Site Location



LAKE MICHIGAN

SITE LOCATION  
OMC PLANT 2

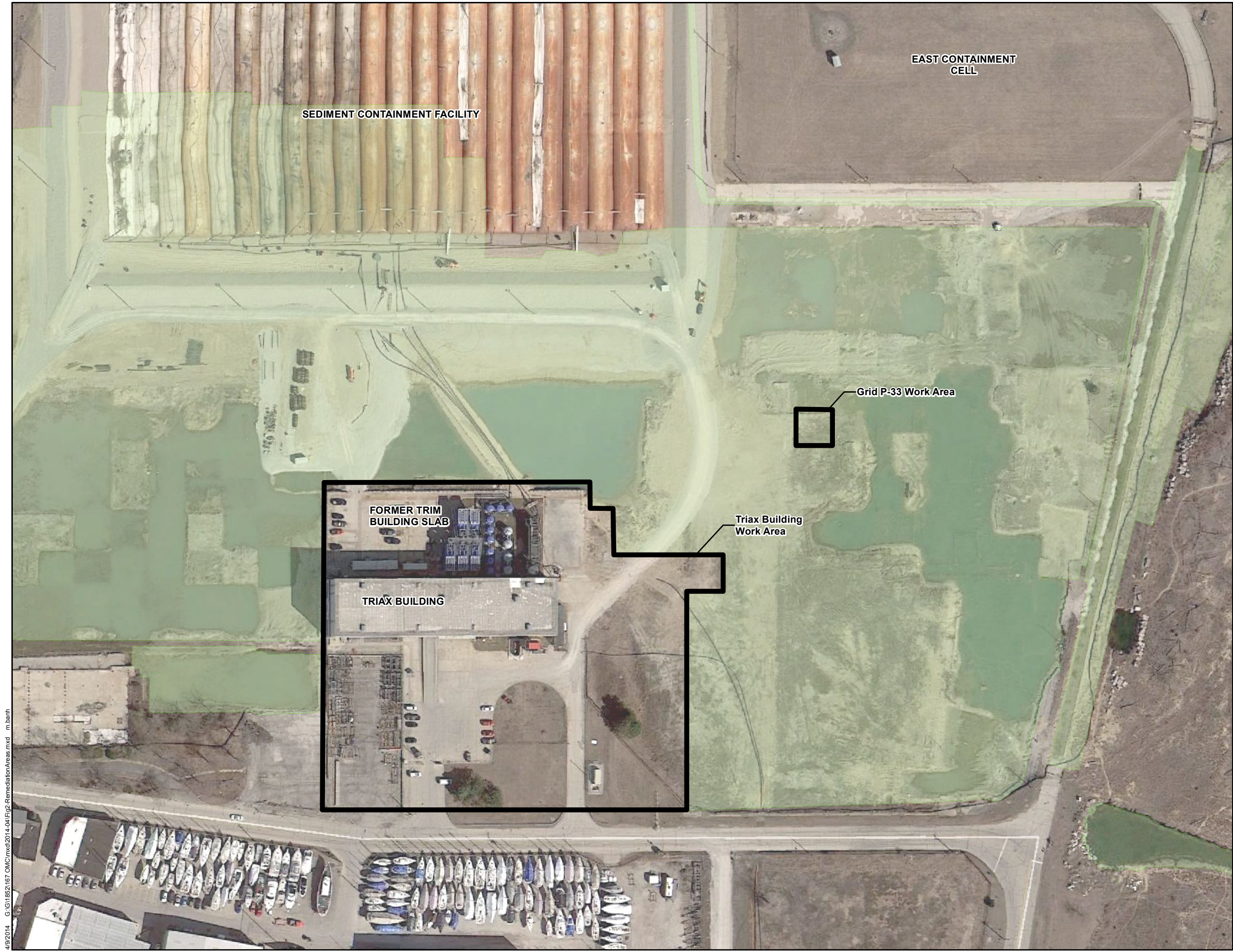


OMC PLANT 2 SITE  
WAUKEGAN, ILLINOIS



**FIGURE 1**  
SITE LOCATION

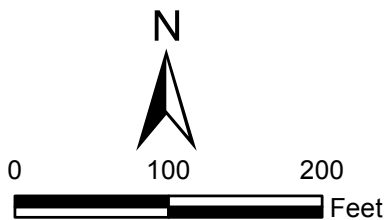






**LEGEND**

-  Remediation Area Boundary
-  Previously Remediated Area

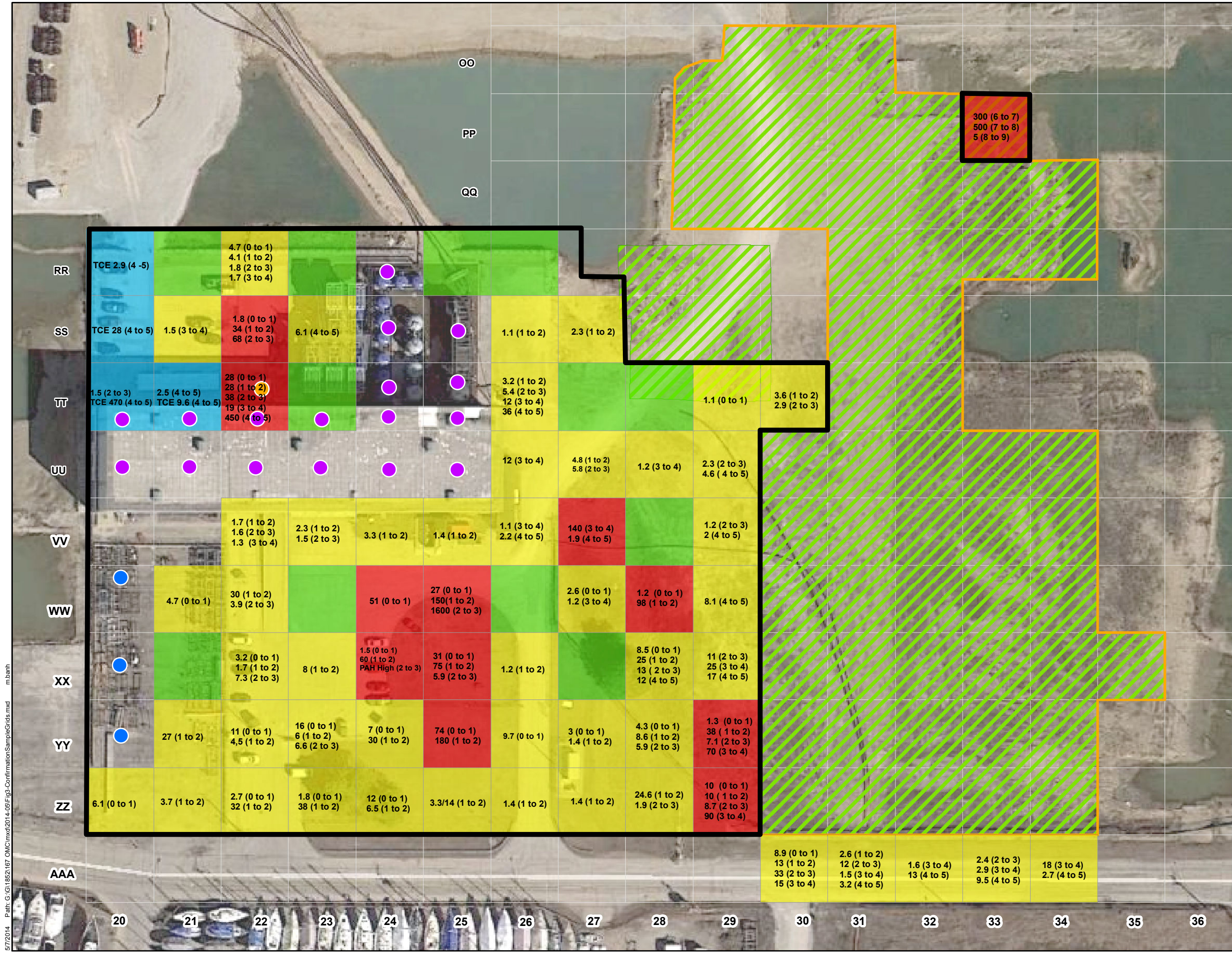


OMC PLANT 2 SITE  
WAUKEGAN, ILLINOIS

**FIGURE 2**  
REMEDICATION AREAS







**LEGEND**  
**Proposed Borings and Concrete Coring**

- Concrete Core and Sample from 0' to 5'
- Concrete Core and Sample from 5' to 7'
- Sample from 0' to 5'

**RESULTS**

- PCB < 1 ppm
- PCB > 1 & < 50 ppm
- PCB > 50 ppm
- VOC > 1 ppm
- RemediationArea Boundary
- West Shelf Remediation and Backfill Area
- Remediation Complete
- 50' x 50' Grids

1.5 (2-3) = PCB result and corresponding depth  
TCE (4-5) = Trichloroethene and corresponding depth  
PAH = Polycyclic Aromatic Hydrocarbon

All results presented in milligrams/kilogram (mg/kg)

OMC PLANT 2 SITE  
WAUKEGAN, ILLINOIS

**FIGURE 3**  
CONFIRMATION SAMPLE GRIDS

5/7/2014 Path: G:\G1852167 OMC\mxd\2014-05\Fig3-ConfirmationSampleGrids.mxd m.banh



## **ATTACHMENT 1**

### **FIELD OPERATING PROCEDURES AND STANDARD OPERATING PROCEDURES**

SOP 002	General Equipment Decontamination
SOP 003	Organic Vapor Monitoring
SOP 005	Soil Sampling
SOP 024	Recording Notes in Field Logbooks

**SOP APPROVAL FORM**



**PROJECT-SPECIFIC  
ENVIRONMENTAL STANDARD OPERATING PROCEDURE**

**GENERAL EQUIPMENT DECONTAMINATION**

**SOP NO. 002**

**REVISION NO. 3**

Last Reviewed: December 2013

A handwritten signature in black ink, appearing to read 'John Dugg'.

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Quality Assurance Approved

04 December 2013

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Date

## **1.0 BACKGROUND**

All nondisposable field equipment must be decontaminated before and after each use at each sampling location to obtain representative samples and to reduce the possibility of cross-contamination.

### **1.1 PURPOSE**

This standard operating procedure (SOP) establishes the requirements and procedures for decontaminating equipment in the field.

### **1.2 SCOPE**

This SOP applies to decontaminating general nondisposable field equipment. To prevent contamination of samples, all sampling equipment must be thoroughly cleaned prior to each use.

### **1.3 DEFINITIONS**

**Alconox:** Nonphosphate soap, obtained in powder detergent form and dissolved in water

**Liquinox:** Nonphosphate soap, obtained in liquid form for mixing with water

### **1.4 REFERENCES**

U.S. Environmental Protection Agency (EPA). 1992a. "Guide to Management of Investigation-Derived Wastes." Office of Solid Waste and Emergency Response. Washington D.C. EPA 9345.3-03FS. January.

EPA. 1992b. "RCRA Ground-Water Monitoring: Draft Technical Guidance." Office of Solid Waste. Washington, DC. EPA/530-R-93-001. November.

EPA. 1994. "Sampling Equipment Decontamination." Environmental Response Team SOP #2006 (Rev. #0.0, 08/11/94). <http://www.ert.org/products/2006.PDF>



## **1.5 REQUIREMENTS AND RESOURCES**

The equipment required to conduct decontamination is as follows:

- Scrub brushes
- Large wash tubs or buckets
- Squirt bottles
- Alconox or Liquinox
- Tap water
- Distilled water
- Plastic sheeting
- Aluminum foil
- Methanol or hexane
- Isopropanol (pesticide grade)
- Dilute (0.1 N) nitric acid

## **2.0 PROCEDURE**

The procedures below discuss decontamination of personal protective equipment (PPE), drilling and monitoring well installation equipment, borehole soil sampling equipment, water level measurement equipment, general sampling equipment, and groundwater sampling equipment.

### **2.1 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION**

Personnel working in the field are required to follow specific procedures for decontamination prior to leaving the work area so that contamination is not spread off site or to clean areas. All used disposable protective clothing, such as Tyvek coveralls, gloves, and booties, will be containerized for later disposal. Decontamination water will be containerized in 55-gallon drums (refer to Section 3.0).

Personnel decontamination procedures will be as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.

3. Wash neoprene boots (or neoprene boots with disposable booties) with Liquinox or Alconox solution and rinse with clean water. Remove booties and retain boots for subsequent reuse.
4. Wash outer gloves in Liquinox or Alconox solution and rinse in clean water. Remove outer gloves and place into plastic bag for disposal.
5. Remove Tyvek or coveralls. Containerize Tyvek for disposal and place coveralls in plastic bag for reuse.
6. Remove air purifying respirator (APR), if used, and place the spent filters into a plastic bag for disposal. Filters should be changed daily or sooner depending on use and application. Place respirator into a separate plastic bag after cleaning and disinfecting.
7. Remove disposable gloves and place them in plastic bag for disposal.
8. Thoroughly wash hands and face in clean water and soap.

## **2.2 DRILLING AND MONITORING WELL INSTALLATION EQUIPMENT DECONTAMINATION**

All drilling equipment should be decontaminated at a designated location on site before drilling operations begin, between borings, and at completion of the project. Decontamination may be conducted on a temporary decontamination pad constructed at satellite locations within the site area in support of temporary work areas. The purpose of the decontamination pad is to contain wash waters and potentially contaminated soil generated during decontamination procedures. Decontamination pads may be constructed of concrete, wood, or plastic sheeting, depending on the site-specific needs and plans. Wash waters and contaminated soil generated during decontamination activities should be considered contaminated and thus, should be collected and containerized for proper disposal.

Monitoring well casing, screens, and fittings are assumed to be delivered to the site in a clean condition. However, they should be steam cleaned and placed on polyethylene sheeting on-site prior to placement downhole. The drilling subcontractor will typically furnish the steam cleaner and water.

The drilling auger, bits, drill pipe, any portion of drill rig that is over the borehole, temporary casing, surface casing, and other equipment used in or near the borehole should be decontaminated by the drilling subcontractor as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. Remove loose soil using shovels, scrapers, wire brush, etc.
4. Steam clean or pressure wash to remove all visible dirt.
5. If equipment has directly or indirectly contacted contaminated media and is known or suspected of being contaminated with oil, grease, polynuclear aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), or other hard to remove organic materials, rinse equipment with pesticide-grade isopropanol.
6. To the extent possible, allow components to air dry.
7. Wrap or cover equipment in clear plastic until it is time to be used.
8. All wastewater from decontamination procedures should be containerized.

### **2.3 BOREHOLE SOIL SAMPLING DOWNHOLE EQUIPMENT DECONTAMINATION**

All soil sampling downhole equipment should be decontaminated before use and after each sample as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. Prior to sampling, scrub the split-barrel sampler and sampling tools in a wash bucket or tub using a stiff, long bristle brush and Liquinox or Alconox solution.
4. After sampling, steam clean the sampling equipment over the rinsate tub and allow to air dry.
5. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
6. Containerize all water and rinsate; disposable single-use sampling equipment should also be containerized.
7. Decontaminate all equipment placed down the hole as described for drilling equipment.

## **2.4 WATER LEVEL MEASUREMENT EQUIPMENT DECONTAMINATION**

Field personnel should decontaminate the well sounder and interface probe before inserting and after removing them from each well. The following decontamination procedures should be used:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. Wipe the tape and probe with a disposable Alconox- or Liquinox-impregnated cloth or paper towel.
4. If immiscible layers are encountered, the interface probe may require steam cleaning or washing with pesticide-grade isopropanol.
5. Rinse with deionized water.

## **2.5 GENERAL SAMPLING EQUIPMENT DECONTAMINATION**

All nondisposable sampling equipment should be decontaminated using the following procedures:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. To decontaminate a piece of equipment, use an Alconox wash; a tap water wash; a solvent (isopropanol, methanol, or hexane) rinse, if applicable, or dilute (0.1 N) nitric acid rinse, if applicable; a distilled water rinse; and air drying. Use a solvent (isopropanol, methanol, or hexane) rinse for grossly contaminated equipment (for example, equipment that is not readily cleaned by the Alconox wash). The dilute nitric acid rinse may be used if metals are the analytes of concern.
4. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
5. Containerize all water and rinsate.

## **2.6 GROUNDWATER SAMPLING EQUIPMENT**

The following procedures are to be employed for the decontamination of equipment used for groundwater sampling. Decontamination is not necessary when using disposable (single-use) pump tubing or bailers. Bailer and downhole pumps and tubing decontamination procedures are described in the following sections.

### **2.6.1 Bailers**

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. Evacuate any purge water in the bailer.
4. Scrub using soap and water and/or steam clean the outside of the bailer.
5. Insert the bailer into a clean container of soapy water. Thoroughly rinse the interior of the bailer with the soapy water. If possible, scrub the inside of the bailer with a scrub brush.
6. Remove the bailer from the container of soapy water.
7. Rinse the interior and exterior of the bailer using tap water.
8. If groundwater contains or is suspected to contain oil, grease, PAHs, PCBs, or other hard to remove organic materials, rinse equipment with pesticide-grade isopropanol.
9. Rinse the bailer interior and exterior with deionized water to rinse off the tap water and solvent residue, as applicable.
10. Drain residual deionized water to the extent possible.
11. Allow components to air dry.
12. Wrap the bailer in aluminum foil or a clean plastic bag for storage.
13. Containerize the decontamination wash waters for proper disposal.

### **2.6.2 Downhole Pumps and Tubing**

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.
3. Evacuate any purge water in the pump and tubing.
4. Scrub using soap and water and/or steam clean the outside of the pump and, if applicable, the pump tubing.
5. Insert the pump and tubing into a clean container of soapy water. Pump/run a sufficient amount of soapy water to flush out any residual well water. After the pump and tubing are flushed, circulate soapy water through the pump and tubing to ensure that the internal components are thoroughly flushed.
6. Remove the pump and tubing from the container.
7. Rinse external pump components using tap water.
8. Insert the pump and tubing into a clean container of tap water. Pump/run a sufficient amount of tap water through the pump to evacuate all of the soapy water (until clear).
9. If groundwater contains or is suspected to contain oil, grease, PAHs, PCBs, or other hard to remove organic materials, rinse the pump and tubing with pesticide-grade isopropanol.
10. Rinse the pump and tubing with deionized water to flush out the tap water and solvent residue, as applicable.
11. Drain residual deionized water to the extent possible.
12. Allow components to air dry.
13. For submersible bladder pumps, disassemble the pump and wash the internal components with soap and water, rinse with tap water, isopropanol (if necessary), and deionized water, and allow to air dry.
14. Wrap pump and tubing in aluminum foil or a clean plastic bag for storage.
15. Containerize the decontamination wash waters for proper disposal.

### **3.0 INVESTIGATION-DERIVED WASTE**

Investigation-derived waste (IDW) can include disposable single-use PPE and sampling equipment, soil cuttings, and decontamination wash waters and sediments. Requirements for waste storage may differ from one facility to the next. Facility-specific directions for waste storage will be provided in project-

specific documents, or separate direction will be provided by the project manager. The following guidelines are provided for general use:

1. Assume that all IDW generated from decontamination activities contains the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. Waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.
2. Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility.
3. Label IDW storage containers with the facility name and address, date, contents, company generating the waste, and an emergency contact name and phone number.
4. Temporarily store the IDW in a protected area that provides access to the containers and allows for spill/leak monitoring, sampling of containers, and removal following determination of the disposal method.

**SOP APPROVAL FORM**



PROJECT-SPECIFIC

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

**ORGANIC VAPOR AIR MONITORING**

**SOP NO. 003**

**REVISION NO. 3**

Last Reviewed: August 2013

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Quality Assurance Approved

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19 August 2013  
Date



## **1.0 BACKGROUND**

Exposure to airborne organic contaminants can present a significant threat to worker health and safety. Identifying and quantifying these contaminants through air monitoring is essential for reconnaissance activities. Reliable measurements of airborne organic contaminants are necessary for selecting or upgrading personal protective equipment (PPE), delineating areas where protection is needed, assessing the potential health effects of exposure, and determining the need for specific medical monitoring. Organic vapor air monitoring is also commonly used as a screening tool to identify relatively impacted environmental media and to provide a real-time basis for selecting samples for chemical analysis.

Various types of air monitoring instruments are available for measuring organic vapors. Common organic vapor monitoring instruments used by SulTRAC include HNu® or Photovac 2020ComboPRO® photoionization detectors (PID), Foxboro® organic vapor analyzer (OVA) flame ionization detectors (FID), Photovac MicroFID, and MiniRae 2000 or 3000 PIDs. It should be noted that this standard operating procedure (SOP) discusses only some of the air monitoring instruments available to field personnel. The particular type of meter or monitoring system to be used should be identified in the project work plan or field sampling plan and selected on a site-specific basis depending on the data collection needs, the types of organic vapors to be monitored, and the sampling procedures to be used.

### **1.1 PURPOSE**

This SOP establishes the general requirements and procedures for using various instruments to conduct organic vapor air monitoring in the field. It also discusses general factors to consider when conducting organic vapor air monitoring.

### **1.2 SCOPE**

This SOP applies to general procedures for calibrating and operating organic vapor air monitoring instruments in the field. The project work plan or field sampling plan should identify the types of instruments to be used and the actual project-specific field parameters to be measured. The project-specific health and safety plan should identify chemical-specific action levels for health and safety purposes. For each type of air monitoring instrument, the manufacturer's manual should be consulted for specific operating instructions.

### 1.3 DEFINITIONS

**Flame ionization:** A process by which a sample gas is ionized with a flame, allowing a count of carbon atoms to determine organic vapor concentration.

**Flame ionization detector (FID):** A portable instrument used to detect, measure, and provide a direct reading of organic vapor concentrations in a gas sample that is ionized with a flame.

**Ionization potential:** The amount of energy needed to strip an electron from the orbit of its resident molecule, expressed in electron volts.

**Organic vapor:** Airborne compounds composed of carbon, hydrogen, and other elements with chain or ring structures.

**Organic vapor analyzer (OVA):** A portable instrument used to detect, measure, and provide a direct reading of the concentration of a variety of trace organic gases in the atmosphere through flame ionization.

**Photoionization:** A process involving the absorption of ultraviolet light by a gaseous molecule, leading to ionization.

**Photoionization detector (PID):** A portable instrument used to detect, measure, and provide a direct reading of the concentrations of a variety of trace organic gases in the atmosphere through photoionization.

**Breathing zone:** The area where field workers would be inhaling potentially impacted air, generally from about 3 to 5 feet above the ground surface. The breathing zone will vary depending on the types of work activities being performed. Air monitoring is conducted in this zone to ensure that it is representative of the air being breathed by field team members.

**Head space:** The vapor mixture trapped above a solid or liquid in a sealed vessel.

## **1.4 REFERENCES**

National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), U.S. Coast Guard, and U.S. Environmental Protection Agency (EPA). 1985. "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities." U.S. Government Printing Office. Washington, DC.

## **1.5 REQUIREMENTS AND RESOURCES**

The following items are typically required to monitor organic vapors in air using this SOP:

- Organic vapor air monitoring meter
- Manufacturer-supplied calibration gas
- Manufacturer-supplied calibration kits including tubing and regulators
- Resealable plastic bags for conducting soil head space measurements (if applicable)
- Sample jars for conducting water head space measurements (if applicable)
- Sharpie or similar type of permanent marker
- Container to collect soil or water used for head space measurements (if applicable)
- Logbook or field data sheets

## **2.0 APPLICATIONS, DETECTION METHODS, AND LIMITATIONS**

All direct-reading instruments have inherent constraints in their ability to detect gaseous organic compounds. They usually detect and/or measure only specific classes of chemicals. Generally, they are not designed to measure and/or detect airborne concentrations below 1 part per million (ppm). Finally, many direct-reading instruments that have been designed to detect one particular substance also detect other substances, causing interference and possibly resulting in false readings. The following subsections discuss general application, detection methods, and limitations when using a PID and an OVA FID.

### **2.1 APPLICATION**

The PID can be used to detect total concentrations of many organic and some inorganic gases and vapors. It can also be used in conjunction with other detection devices such as colorimetric indicator detector

tubes to identify specific compounds (see SOP No. 065, Colorimetric Indicator Detectors [Dräger Tubes]).

When set in the survey mode, the OVA FID can detect the total concentration of many organic gases and vapors. In the gas chromatography (GC) mode, the OVA FID can identify and measure the concentrations of specific compounds. In the survey mode, all organic compounds are ionized and detected at the same time. In the GC mode, volatile species are ionized and detected separately.

Each type of unit (PID or FID) has some limitations as to the detection of various categories of compounds or for specific organic compounds. Examples are described below in Section 2.2. The user manual for the specific instrument should be used to confirm its applicability for measurements of the organic vapors of concern at the site.

## **2.2 DETECTION METHODS**

The PID ionizes molecules using ultraviolet (UV) radiation and can be used with a variety of electron voltage lamps best matched to the compound of concern at a site. The UV radiation strips electrons from the molecules, producing ions that produce a current proportional to the number of ions generated. The PID is more sensitive to aromatic and unsaturated compounds than the OVA FID. The PID is nonspecific for gas and vapor detection for organic and some inorganic compounds. The PID is also sensitive to 0.1 ppm of benzene. Sensitivity is related to the ionization potential of the compound being monitored. PIDs will only detect compounds that have ionization energies similar to the energy of the photons the detector uses. Gases with ionization potential values below the electron volt (eV) output of the lamp will be detected. The most common PID lamp used is the 10.6 eV lamp because it detects most volatile organic compounds; however, 9.5 eV and 11.7 eV lamps are also commonly available. It is recommended that the ionization potential of the chemicals of concern be known in order to select the most appropriate lamp for a specific project. Ionization potential information can be obtained from the vendor, in the manufacturer's manual, or on line (for example, at <http://www.equipcoservices.com/support/reference/ionization-potentials-of-common-chemicals/> ).

Organic gases and vapors are flame-ionized in the OVA FID. The ions produce a current that is proportional to the number of carbon atoms present. The current is interpreted by a deflection on the instrument's meter. In the survey mode, the OVA FID functions as a nonspecific total hydrocarbon analyzer. In the GC mode, the OVA FID can provide a tentative qualitative and quantitative identification of gases and vapors. The OVA FID is most sensitive to saturated hydrocarbons (alkanes),

unsaturated hydrocarbons (alkenes), and aromatic hydrocarbons. The OVA FID is not suitable for inorganic gases such as chlorine, hydrogen cyanide, and ammonia. The OVA FID is also less sensitive to aromatics and unsaturated compounds than the PID. However, the OVA FID is less sensitive to high humidity than the PID. Gases and vapors that contain substituted function groups such as hydroxide (OH-) reduce the detector's sensitivity. Finally, if the operator monitors for a specific gas or vapor, the operator should use a calibration standard and GC column specific to that particular gas or vapor.

## **2.3 LIMITATIONS**

The PID cannot be used to:

- Detect methane
- Detect a compound that has a higher energy level than the ionization potential of the PID light source
- Respond accurately to a mixture of gases or vapors
- Respond accurately in high humidity or very cold weather
- Respond accurately when interference from other sources is present

The OVA FID cannot be used to:

- Detect organic vapors at temperatures below 40 °F (4 °C)
- Identify specific organic vapors when operated in the survey mode; results must be reported relative to the calibration standard used (for example, as methane equivalents).
- Detect inorganic gases and vapors; the instrument also gives a lower response to oxygen-containing organic compounds (such as alcohols, ethers, and aldehydes) and nitrogen-containing organic compounds (such as amines, amides, and nitriles).

Detect high organic contaminant concentrations or detect contaminants in oxygen-deficient atmospheres; operation in these conditions requires system modification.

## **3.0 PROCEDURES**

The procedures outlined in this SOP are general and typically apply to various types of monitoring instruments used to measure organic vapors in air. General procedures for testing and calibrating the instruments are presented first, followed by procedures for using the instruments and making field

measurements, guidelines for recording information accurately, and a discussion of variables that may affect outdoor air monitoring. The particular monitoring instrument should be identified in the project work plan or field sampling plan and should be operated in accordance with the manufacturer's instruction manual.

### **3.1 TESTING AND CALIBRATION PROCEDURES**

Each air monitoring instrument should be calibrated according to manufacturer's specifications. General procedures applicable to most equipment are as follows:

- Equipment should be thoroughly cleaned, and then calibrated and tested before the startup of sampling at each site.
- Equipment should be calibrated and tested using manufacturer-provided calibration gas and calibration connector kits.
- Batteries should be charged prior to startup of field work, and the battery charge level should be checked at the start of each day. The battery charge life will vary depending on the particular monitoring instrument to be used and the application.
- It is recommended that extra batteries be kept on hand when conducting field work.
- The PID can typically run continuously on a fully charged battery for at least 8 hours. The PID battery should be recharged for 14 hours.
- The OVA FID can typically run continuously on a fully charged battery for 8 hours alone or for 3 hours with a strip chart recorder. The OVA FID battery must be recharged every 8 hours or replaced, as needed.
- Calibration and testing of field equipment should be documented every time it is performed. Calibration and testing information should be recorded in field logbooks (or field data sheets, if applicable).
- If testing and calibration measurements are out of tolerance, the instrument must be serviced or repaired.

### **3.2 FIELD MEASUREMENT PROCEDURES**

Each air monitoring instrument should be operated according to manufacturer's specifications. The actual field procedures will vary depending on the type of air monitoring to be conducted. Almost all PIDs and OVA FIDs have a recommended warm-up period (see the manufacturer's operations manual for the specific type of meter to be used). Similarly, many instruments are affected by moisture, humidity, and dust. The use of an external filter on the probe tip is recommended in these situations. Finally, many

instruments include a data logging option that can be used, if desired. A general procedural summary for air monitoring associated with health and safety and field screening applications is presented below.

### **3.2.1 Health and Safety Monitoring**

The site-specific health and safety plan will specify the types of contaminants of concern, health and safety related action levels, and the types of PPE necessary. The goal of air monitoring for health and safety purposes is to ensure that field work is conducted in accordance with the health and safety plan and to identify conditions where upgrading the level of PPE may be necessary. General procedures for conducting health and safety air monitoring for organic vapors are as follows:

- Following the instrument manual, calibrate and test air monitoring equipment.
- Approach the sampling location from the upwind direction.
- Monitor organic vapors in the breathing zone (multiple levels of monitoring may be required depending on the work being performed).
- Monitor down-hole vapor concentrations, if drilling.
- Take readings at a frequency appropriate for the types of tasks being conducted, the types of organic vapors expected, and the levels of organic vapors being detected (monitor at a more frequent rate if organic vapors are detected and they are near the site-specific action levels specified in the health and safety plan).
- Record information in a field log book, on field data sheets, or on an air monitoring log sheet (record site name, date and time, sampling location, PID or FID readings, and pertinent weather information).
- Upgrade the level of PPE, implement engineering controls, or stop work if organic vapors are sustained in the breathing zone above action levels specified in the site-specific health and safety plan.

### **3.2.2 Field Screening**

The site-specific work plan or field sampling plan will specify the media to be sampled, the sampling methods and procedures to be used, and field screening requirements. Typically, the goals of air monitoring for field screening purposes are to identify relatively higher organic vapor concentrations in soil, groundwater, or other media to select subsequent sampling locations, or to select environmental samples to send to a laboratory for chemical analysis. General procedures for conducting field screening air monitoring for organic vapors are as follows:

- Following the instrument manual, calibrate and test air monitoring equipment.
- Work from the upwind direction, when possible.
- Directly screen soil cores or drill cuttings by running the tip of the meter along the soil surface while taking care not to get soil into the probe.
- Depending on sampling protocol, dig into or freshly “break” the soil and measure vapors at the newly exposed surface.
- When collecting soil samples for head space measurements, place soil in a resealable plastic bag, record the sampling location and depth on the bag with a Sharpie or other type of permanent marker, wait at least 5 minutes for vapors to accumulate (the bag may be placed in direct sunlight or in a warm area while waiting), shake the bag vigorously, and then insert the probe into the bag without placing the tip directly in the soil (while taking care not to let vapors escape).
- Directly screen purged well water (or surface water) by running the tip of the meter along the water surface while taking care not to get water into the probe.
- When collecting water samples for head space measurements, place water in a jar and tightly close the lid, record the sampling location and depth on the jar with a Sharpie or other type of permanent marker, wait at least 5 minutes for vapors to accumulate (the jar may be placed in direct sunlight or in a warm area while waiting), shake the jar vigorously, and then slightly open the lid and insert the probe into the jar without placing the tip directly in the water (while taking care not to let vapors escape).
- Record information in a field log book, on field data sheets, or on an air monitoring log sheet (record site name, date and time, sampling location, PID or FID readings, and pertinent weather information).

### **3.3 ACCURATE RECORDING AND INTERPRETATION**

Direct-reading instruments must be operated and the data interpreted by individuals who understand the operating principles and limitations of the instruments. At hazardous waste sites, where unknown and multiple contaminants are frequently encountered, instrument readings should be interpreted conservatively.

The following guidelines promote accurate recording and interpretation:

- Calibrate instruments in accordance with the manufacturer’s instructions before and after every use.
- Conduct additional monitoring at any location where a positive response occurs.



- Report a reading of zero as nondetectable (ND) rather than as “clean.” Quantities of chemicals may be present but at concentrations that are not detectable by the instrument.
- Repeat the air monitoring survey using other detection devices.

### 3.4 VARIABLES AFFECTING OUTDOOR AIR MONITORING

Complex environments containing many substances, such as those associated with hazardous waste sites, pose significant challenges to accurately and safely assess airborne contaminants. Several independent and uncontrollable variables (most notably temperature and weather conditions) can affect airborne concentrations. These factors must be considered when conducting air monitoring and interpreting data. The following environmental variables must be considered:

- **Temperature:** An increase in temperature increases the vapor pressure of most chemicals.
- **Wind speed:** An increase in wind speed can affect vapor concentration near a free-standing liquid surface. Dust and particulate-bound contaminants are also affected.
- **Rainfall:** Water from rainfall can essentially cap or plug vapor emission routes from open or closed containers, saturated soil, or lagoons, thereby reducing airborne emissions of certain substances.
- **Moisture:** Dusts, including finely divided hazardous solids, are highly sensitive to moisture. Moisture can vary significantly with respect to location and time and can also affect the accuracy of many sampling results.
- **Background vapor emissions:** Vapor emission from other activities in the area of the field investigations can also impact readings. Operations such as vehicle maintenance or fueling facilities can affect readings associated with perimeter monitoring.
- **Work activities:** Work activities often require the mechanical disturbance of contaminated materials, which may change the concentration and composition of airborne contaminants and contribute to airborne emissions. Organic air emissions at a work site can also occur from operation of gasoline or diesel engines.

These conditions should be reported with organic vapor readings to provide a more accurate interpretation of monitoring results.

**SOP APPROVAL FORM**



**PROJECT-SPECIFIC  
ENVIRONMENTAL STANDARD OPERATING PROCEDURE**

**SOIL SAMPLING**

**SOP NO. 005**

**REVISION NO. 2**

Last Reviewed: August 2013

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Quality Assurance Approved

19 August 2013

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Date

## **1.0 BACKGROUND**

Soil sampling is conducted for three main reasons: for laboratory chemical analysis, laboratory physical analysis, or visual classification and field screening. These three sampling objectives can be achieved separately or in combination with each other. Sampling locations are typically chosen to provide chemical, physical, or visual information in both the horizontal and vertical directions. A sampling and analysis plan is used to outline sampling methods and provide preliminary rationale for sampling locations. Sampling locations may be adjusted in the field based on the screening methods being used and the physical features of the area.

### **1.1 PURPOSE**

Soil sampling is conducted to determine the chemical, physical, and visual characteristics of surface and subsurface soils.

### **1.2 SCOPE**

This standard operating procedure (SOP) describes procedures for soil sampling in different areas using various implements. It includes procedures for test pit, surface soil, and subsurface soil sampling, and describes ten soil sampling devices.

### **1.3 DEFINITIONS**

**Hand auger:** Instrument attached to the bottom of a length of pipe that has a crossarm or “T” handle at the top. The auger can be closed-spiral or open-spiral.

**Bucket auger:** A type of auger that consists of a cylindrical bucket 10 to 72 inches in diameter with teeth arranged at the bottom.

**Core sampler:** Thin-wall cylindrical metal tube with diameter of 0.5 to 3 inches, a tapered nosepiece, a “T” handle to facilitate sampler deployment and retrieval, and a check valve (flutter valve) in the headpiece.

**EnCore™ sampler:** A disposable volumetric sampling device. It comes in sample sizes of 5 and 25 grams. It is a hermetically sealed, single-use soil sampler made from a high-tech, inert polymer. EnCore™ samplers are used to collect soil samples with zero headspace, as required for volatile organic compound analysis. Each sample is collected using a reuseable “T” handle.

**Spatulas or Spoons:** Stainless steel or disposable instruments for collecting loose unconsolidated material.

**Trier:** Tube cut in half lengthwise with a sharpened tip that allows for collection of sticky solids or loosening of cohesive soils.

**Trowel:** Metal or disposable tool with a scooped blade 4 to 8 inches long and 2 to 3 inches wide with a handle.

**Split-Spoon (or Split-Barrel) Sampler:** Thick-walled steel tube that is split lengthwise. A cutting shoe is attached to the lower end; the upper end contains a check valve and is connected to drill rods.

**Thin-Wall Tube Sampler:** Steel tube (1 to 3 millimeters thick) with a tapered bottom edge for cutting. The upper end is fastened to a check valve that is attached to drill rods.

**Volatile Organics Analysis (VOA) Plunger:** Disposable, plastic, single-use soil sample collection device for volatile organic compound sample collection.

## **1.4 REFERENCES**

- U.S. Environmental Protection Agency. (EPA) 1984. “Soil Sampling Quality Assurance Users Guide.” EPA 600/4-84-043.
- EPA. 1980. “Samplers and Sampling Procedures for Hazardous Waste Streams.” EPA 600/2-80-018. January.
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EPA. 1991. “Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells.” March. EPA/600/4-89/034.

EPA. 1994. “Soil Sampling.” Environmental Response Team SOP #2012 (Rev. #0.0, 11/16/94).  
<http://www.ert.org/products/2012.pdf>

EPA. 1996. SW-846, Method 5035, Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples. December.  
<http://www.epa.gov/epawaste/hazard/testmethods/sw846/pdfs/5035.pdf>

## **1.5 REQUIREMENTS AND RESOURCES**

Soil sampling requires the use of one or more of the following types of equipment:

- Spoons and spatulas
- Trowel
- Shovel or spade
- Trier
- Core sampler
- EnCore™ sampler
- VOA Plunger
- Hand auger
- Bucket auger
- Split-spoon
- Thin-wall tube

In addition, the following equipment is also needed for various methods:

- Sample containers, labels, and chain-of-custody forms
- Logbook
- Tape for measuring recovery
- Soil classification information
- Wax or caps for sealing ends of thin-wall tube
- “T” Handles
- Plastic sheeting
- Decontamination equipment
- Drilling equipment
- Backhoe
- Health and safety equipment

## **2.0 SOIL SAMPLING PROCEDURES**

This SOP presents procedures for conducting test pit, surface soil, and subsurface soil sampling. The site sampling plan will specify which of the following procedures will be used.

Soil samples for chemical analysis should be collected in the following order: (1) volatile organics, (2) semivolatile organics, and (3) metals. Once the chemical samples have been containerized, samples for physical analyses can be containerized. Typical physical analyses conducted include (1) grain size distribution, (2) moisture content, (3) saturated permeability, (4) unsaturated permeability, and (5) Atterberg limits. Additionally, visual descriptions of samples, using the Unified Soil Classification System (USCS), should be recorded. Field tests such as head space analyses can also be conducted.

Soil samples for chemical analyses can be collected either as grab samples or composite samples. A grab sample is collected from a discrete location or depth. A composite sample consists of soil combined from more than one discrete location. Typically, composite samples consist of soil obtained from several locations and homogenized in a stainless steel or Teflon<sup>®</sup> pan, tray, or baggie. Refer to the site-specific Quality Assurance Project Plan (QAPP) for methodology for composite sample collection. Samples for volatile organics analysis should not be composited.

All soil samples collected should be packaged and shipped to the laboratories in accordance with SOP 019. All nondedicated or nondisposable equipment used for soil sampling should be decontaminated between sampling locations in accordance with SOP 002.

### **2.1 SOIL SAMPLE COLLECTION PROCEDURES**

Soil samples can be collected as discrete samples for volatile organic compound (VOC) analysis using specialized equipment for preservation in the laboratory or in the field. Soil samples collected for non-VOC analysis can be collected as either grab or composite samples using standard equipment.

#### **2.1.1 Procedure for Preserving and Collecting Soil Samples for VOC analysis**

Samples collected for VOC analysis using traditional methods, such as collection in a jar with no preservation, are shown to yield nonrepresentative samples due to loss of VOCs. To prevent such losses,

preservation with methanol or sodium bisulfite may be used to minimize volatilization and biodegradation. This preservation may be performed in the laboratory or in the field, depending on the sample collection methodology used. The specific sampling methodology will be specified in the project-specific QAPP or work plan.

Soil samples to be preserved in the laboratory are collected using SW-846 Method 5035. For samples preserved in the field, laboratories may perform low-level analysis (sodium bisulfate preservation) or high- to medium-level analyses (methanol preservation), depending on the project-specific QAPP.

The following procedures outline the necessary steps for collecting soil samples to be preserved at the laboratory, and for collecting soil samples to be preserved in the field with methanol or sodium bisulfate.

#### **2.1.1.1 Soil Samples to be Preserved at the Laboratory**

Soil samples collected for VOC analysis that are to be preserved at the laboratory shall be obtained using a hand-operated, hermetically sealed sample vial such as an EnCore™ sampler. Each sample shall be obtained using a reusable sampling handle (“T” handle) that can be provided with the EnCore™ sampler when requested and purchased. Collect the soil sample in the following manner for each EnCore™ sampler.

The EnCore™ sampler is loaded into the “T” handle with the plunger fully depressed. Press the “T” handle into the soil to be sampled. The plunger will be forced upward as the cavity fills with soil. When the sampler is full, using the “T” handle, rotate the plunger and lock it into place. If the plunger does not lock, then it is not filled with soil. Soft soil may require several plunges or forcing soil against a hard surface such as a decontaminated sample trowel to ensure headspace has been eliminated. Remove soil from the outside of the sampler so a tight seal can be made between the sample cap and the O-ring. With soil slightly piled above the rim of the sampler, force the cap on until the catches hook the side of the sampler. Remove any surface soil from outside of the sampler and place in the foil bag provided with the sampler. Label the bag with sample location information. Typically, collect three EnCore™ samplers per sample location. Decontaminate the “T” handle between sample locations.

Using the EnCore™ sampler eliminates the need for field preservation and the shipping restrictions associated with preservatives. A complete set of instructions is included with each EnCore™ sampler.

After the EnCore™ samples are collected, they should be placed on ice immediately and delivered to the laboratory within 48 hours. The samples must be preserved by the laboratory within 48 hours of collection.

#### **2.1.1.2 Soil Samples to be Preserved in the Field**

Soil samples preserved in the field may be prepared for analysis using both the low-level (sodium bisulfate preservation) and high- to medium-level (methanol preservation) methods. If samples effervesce when placed in preservative, it is necessary to collect a sample unpreserved, in deionized water. In addition, an unpreserved sample for determination of moisture content must also be collected when collecting soil samples to be preserved in the field.

**Methanol Preservation (High to Medium Level).** Bottles may be pre-spiked with methanol in the laboratory or prepared in the field. Soil samples to be preserved in the field with methanol shall utilize 40- to 60-milliliter (mL) glass vials with septum-lined lids. Each sample bottle shall be filled with 25 mL of demonstrated analyte-free purge-and-trap grade 3 methanol. The preferred method for adding methanol to the sample bottle is by removing the lid and using a pipette or scaled syringe to add the methanol directly to the bottle.

Soil shall be collected with the use of a decontaminated (or disposable), small-diameter coring device such as a disposable VOA plunger. The outside diameter of the coring device must be smaller than the inside of the sample bottle neck. To collect the sample, pull the plunger back to the required location, insert it into the soil to be sampled, push the coring device into the soil, extrude the soil sample into the methanol-preserved sample bottle, and cap the bottle tightly. Swirl the sample (do not shake) in the methanol to break up the soil such that all of the soil is covered with methanol. Place the sample on ice immediately.

**Sodium Bisulfate Preservation (Low Level).** Bottles may be prepared in the laboratory or in the field with sodium bisulfate solution. Samples to be field-preserved using sodium bisulfate are collected using the same procedures described for methanol preservation.



### **2.1.2 Procedure for Collecting Soil Samples for Non-VOC Analyses**

Samples collected for non-VOC analyses may be collected as either grab or composite samples as follows. Using a sampling device, transfer a portion of soil to be sampled to a stainless steel bowl, disposable inert plastic tray, or baggie. Remove roots, vegetation, sticks, and stones larger than the size of pea gravel. Thoroughly mix the soil to obtain as uniform a texture and color as practicable. Transfer the mixed soil to the appropriate sample containers and close the containers. Place the sample containers immediately on ice.

## **2.2 TEST PIT AND TRENCH SOIL SAMPLING**

Test pit and trench soil sampling is conducted when a complete soil profile is required or as a means of locating visually detectable contamination. This type of sampling provides a detailed description of the soil profile and allows for multiple samples to be collected from specific soil horizons. Prior to conducting any test pit or trench excavation with a backhoe, the sampling team should ensure that the sampling area is clear of utility lines, subsurface pipes, and poles.

A test pit or trench is excavated by incrementally removing soil material with a backhoe bucket. The excavated soil is placed on plastic sheeting well away from the edge of the test pit. A test pit should not be excavated to depths greater than 4 feet unless its walls are properly sloped or stabilized. No personnel shall enter any test pit or trench excavation over 4 feet deep; such action would constitute confined space entry and must conform with Occupational Safety and Health Administration (OSHA) regulations at Title 29 of the *Code of Federal Regulations* § 1910.

Personnel entering the test pit may be exposed to toxic or explosive gases and oxygen deficient environments. Air monitoring is required before entering the test pit, and the use of appropriate respiratory gear and protective clothing is mandatory. At least two persons must be present at the test pit before sampling personnel may enter the excavation and begin soil sampling. Refer to project-specific Health and Safety Plans for required safety procedures for excavations.

Soil samples can also be obtained directly from the backhoe bucket or from the excavated material after it has been removed and deposited on plastic sheeting. The sampling personnel shall direct the backhoe excavator to obtain material from the selected depth and location within the excavation. The backhoe

operator shall set the backhoe bucket on the ground in a designated location, at a sufficient distance from the excavation to allow the sampler safe access to the bucket. The backhoe operator shall disengage the controls and signal to the sampler that it is safe to approach the bucket. The soil sample shall then be collected from the center of the backhoe bucket to reduce the potential for cross-contamination of the sample.

Test pits are not practical for sampling at depths greater than 15 feet. If soil samples are required from depths greater than 15 feet, samples should be obtained using test borings instead of test pits. Test pits are also usually limited to a few feet below the water table. In some cases, a pumping system may be required to control the water level within the pits.

Access to open test pits should be restricted by the use of flagging, tape, or fencing. If a fence is used, it should be erected at least 6 feet from the perimeter of the test pit. The test pit should be backfilled as soon as possible after sampling is completed.

Various equipment may be used to collect soil samples from the walls or bottom of a test pit. A hand auger, bucket auger, or core sampler can be used to obtain samples from various depths. A trier, trowel, EnCore™ sampler, VOA plunger, or spoon can be used to obtain samples from the walls or pit bottom surface.

### **2.3 SURFACE SOIL SAMPLING**

The surface soil sampling equipment presented in this SOP is best suited for sampling to depths of 0 to 6 feet below ground surface (bgs). The sample depth, sample analyses, soil type, and soil moisture will also dictate the most suitable sampling equipment. Prior to sample collection, the sampling locations should be cleared of any surface debris such as twigs, rocks, and litter. The following table presents various surface soil sampling equipment and their effective depth ranges, operating means (manual or power), and sample types collected (disturbed or undisturbed).

<b>Sampling Equipment</b>	<b>Effective Depth Range (feet bgs)</b>	<b>Operating Means</b>	<b>Sample Type</b>
Hand Auger	0 to 6	Manual	Disturbed
Bucket Auger	0 to 4	Power	Disturbed
Core Sampler	0 to 4	Manual or Power	Undisturbed
EnCore™ Sampler	Not Applicable	Manual	Disturbed
Spoon/Spatula	0 to 0.5	Manual	Disturbed
Trowel	0 to 1	Manual	Disturbed
VOA Plunger	Not Applicable	Manual	Disturbed

The procedures for using these various types of sampling equipment are discussed below.

### **2.3.1 Hand Auger**

A hand auger equipped with extensions and a “T” handle is used to obtain samples from depths of up to 6 feet bgs. If necessary, a shovel may be used to excavate the topsoil to reach the desired subsoil level. If topsoil is removed, its thickness should be recorded. Samples obtained using a hand auger are disturbed in their collection; determining the exact depth at which samples are obtained is difficult.

The hand auger is screwed into the soil at an angle of 45 to 90 degrees from horizontal. When the entire auger blade has penetrated soil, the auger is removed from the soil by lifting it straight up without turning it, if possible. If the desired sampling depth has not been reached, the soil is removed from the auger and deposited onto plastic sheeting. This procedure is repeated until the desired depth is reached and the soil sample is obtained. The auger is then removed from the boring and the soil sample is collected directly from the auger into an appropriate sample container.

### **2.3.2 Bucket Auger**

A bucket auger, equipped similarly as the hand auger, is used to obtain disturbed samples from depths of up to 4 feet bgs. A bucket auger should be used when sampling stony or dense soil that prohibits the use of a hand-operated core or screw auger. A bucket auger with closed blades is used in soil that cannot generally be penetrated or retrieved by a core sampler.

The bucket auger is rotated while downward pressure is exerted until the bucket is full. The bucket is then removed from the boring, the collected soil is placed on plastic sheeting, and this procedure is repeated until the appropriate depth is reached and a sample is obtained. The bucket is then removed from the boring and the soil sample is transferred from the bucket to an appropriate sample container.

### **2.3.3 Core Sampler**

A hand-operated core sampler (Figure 1), similarly equipped as the hand auger, is used to obtain samples from depths of up to 4 feet bgs in uncompacted soil. The core sampler is capable of retrieving undisturbed soil samples and is appropriate when low concentrations of metals or organics are of concern. The core sampler should be constructed of stainless steel. A polypropylene core sampler is generally not suitable for sampling dense soils or sampling at greater depths.

The core sampler is pressed into the soil at an angle of 45 to 90 degrees from horizontal and is rotated when the desired depth is reached. The core is then removed, and the sample is placed into an appropriate sample container.

### **2.3.4 Shovel**

A shovel may be used to obtain large quantities of soil that are not readily obtained with a trowel. A shovel is used when soil samples from depths of up to 6 feet bgs are to be collected by hand excavation; a tiling spade (sharpshooter) is recommended for excavation and sampling. A standard steel shovel may be used for excavation; either a stainless steel or polypropylene shovel may be used for sampling. Soil excavated from above the desired sampling depth should be stockpiled on plastic sheeting. Soil samples should be collected from the shovel and placed into the sample container using a stainless-steel scoop, plastic spoon, or other appropriate tool.

### **2.3.5 Trier**

A trier (Figure 2) is used to sample soil from depths up to 1 foot bgs. A trier should be made of stainless steel or polypropylene. A chrome-plated steel trier may be suitable when samples are to be analyzed for organics and heavy metal content is not a concern.

Samples are obtained by inserting the trier into soil at an angle of up to 45 degrees from horizontal. The trier is rotated to cut a core and is then pulled from the soil being sampled. The sample is then transferred to an appropriate sample container.

### **2.3.6 Trowel**

A trowel is used to obtain surface soil samples that do not require excavation beyond a depth of 1 foot. A trowel may also be used to collect soil subsamples from profiles exposed in test pits. Use of a trowel is practical when sample volumes of approximately 1 pint (0.5 liter) or less are to be obtained. Excess soil should be placed on plastic sheeting until sampling is completed. A trowel should be made of stainless steel or galvanized steel. It can be purchased from a hardware or garden store. Soil samples to be analyzed for organics should be collected using a stainless steel trowel. Samples may be placed directly from the trowel into sample containers.

## **2.4 SUBSURFACE SOIL SAMPLING**

Subsurface soil sampling is accomplished in conjunction with borehole drilling, for soil sampling from depths greater than approximately 6 feet bgs. Subsurface soil sampling is frequently coupled with exploratory boreholes or monitoring well installation.

Subsurface soil sampling may be conducted using a drilling rig, power auger, or direct-push technology (DPT). Selection of sampling equipment depends upon geologic conditions and the scope of the sampling program. Two types of samplers used with machine-driven augers—the split-spoon sampler and the thin-wall tube sampler—are discussed below. All sampling tools should be cleaned before and after each use in accordance with SOP No. 002 (General Equipment Decontamination). Both the split-spoon sampler and the thin-wall tube sampler can be used to collect undisturbed samples from

unconsolidated soils. The procedures for using the split-spoon and thin-wall tube samplers are presented below.

#### **2.4.1 Split-Spoon Sampler**

Split-spoon samplers are available in a variety of types and sizes. Site conditions and project needs, such as large sample volume for multiple analyses, determine the specific type of split-spoon sampler to be used. Figure 3 shows a generic split-spoon sampler.

The split-spoon sampler is advanced into the undisturbed soil beneath the bottom of the casing or borehole using a weighted hammer and a drill rod. The relationship between hammer weight, hammer drop, and number of blows required to advance the split-spoon sampler in 6-inch increments indicates the density or consistency of the subsurface soil. After the split-spoon sampler has been driven to its intended depth, it should be removed carefully to avoid loss of sample material. In noncohesive or saturated soil, a catcher or basket should be used to help retain the sample.

After the split-spoon sampler is removed from the casing, it is detached from the drill rod and opened. If VOA samples are to be collected, EnCore™ samplers or VOA plungers should be filled with soil taken directly from the split-spoon sampler. Samples for other specific chemical analyses should be taken as soon as the VOA sample has been collected. The remainder of the recovered soil can then be used for visual classification of the sample and containerized for physical analysis. The entire sample (except for the top several inches of possibly disturbed material) is retained for analysis or disposal.

#### **2.4.2 Thin-Wall Tube Sampler**

A thin-wall tube sampler, sometimes called the Shelby tube (Figure 4), is used to collect soil samples for geophysical analysis. Tube samplers are best suited for collecting cohesive soils such as clays and silts. The tube sampler may be pressed or driven into soil inside a hollow-stem auger flight, wash bore casing, or uncased borehole. The tube sampler is pressed into the soil, without rotation, to the desired depth or until refusal. If the tube cannot be advanced by pushing, it may be necessary to drive it into the soil without rotation using a hammer and drill rod. The tube sampler is then rotated to collect the sample from the soil and removed from the borehole.

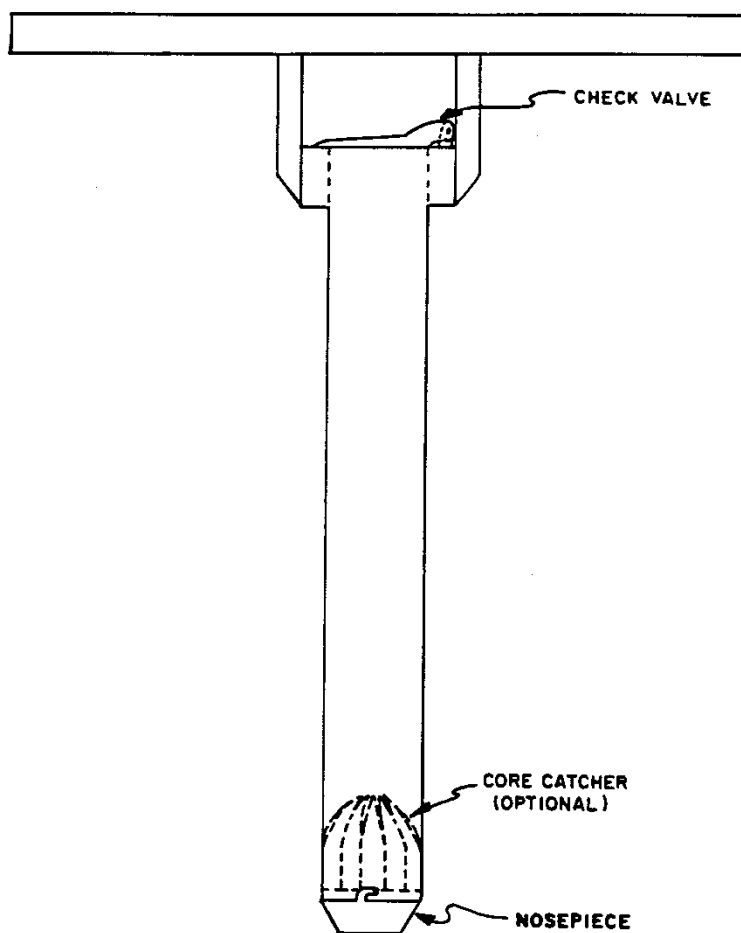
After removal of the tube sampler from the drilling equipment, the tube sampler should be inspected for adequate sample recovery. The sampling procedure should be repeated until an adequate soil core is obtained (if sample material can be retained by the tube sampler). The soil core obtained should be documented in the logbook. Any disturbed soil is removed from each end of the tube sampler. If chemical analysis is required, VOA samples must be collected immediately after the tube sampler is withdrawn. EnCore™ samplers or VOA plungers should be filled with soil taken directly from the tube sampler. Before use, and during storage and transport, the tube sampler should be capped with a nonreactive material. For physical sampling parameters, the tube is sealed using plastic caps. The top and bottom of the tube sampler should be labeled and the tube sampler should be stored accordingly.

#### **2.4.3 Direct-Push Technology Sampler**

Geoprobe systems utilize DPT. In many cases, DPT is less expensive and faster than collecting soil samples with a standard drilling rig. In addition, the use of DPT causes minimal disturbance to the ground surface and generates little to no soil cuttings. DPT uses acetate or clear polyvinyl chloride (PVC) sleeves for collecting soil samples.

Upon retrieval of the sampling rod from the ground, the sample sleeve is extruded from the sampling rod. The sleeve is sliced lengthwise twice, to open the sleeve. Soil samples can be collected directly from the opened sleeve. If VOA samples are to be collected, EnCore™ samplers or VOA plungers should be filled with soil taken directly from the opened DPT sampler. Samples for other specific chemical analyses should be taken after the VOA sample has been collected. The remainder of the recovered soil can then be used for visual classification of the sample and containerized for physical analysis. The entire sample is retained for analysis or disposal.

**FIGURE 1**  
**HAND-OPERATED CORE SAMPLER**

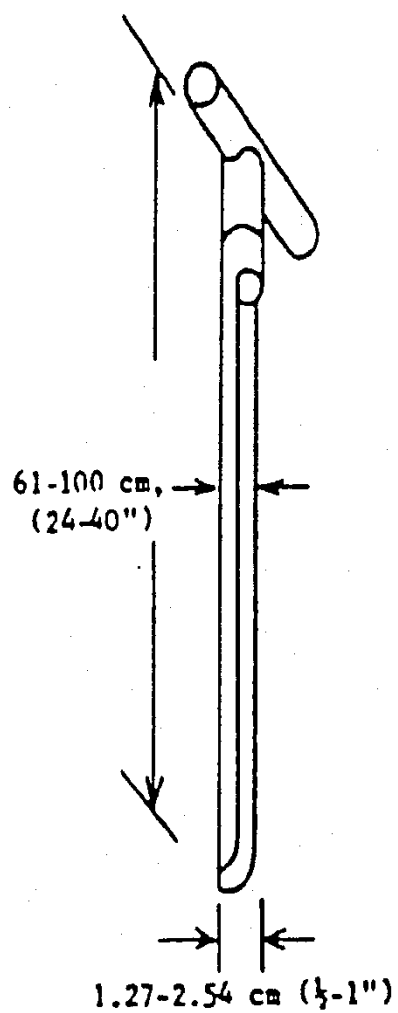




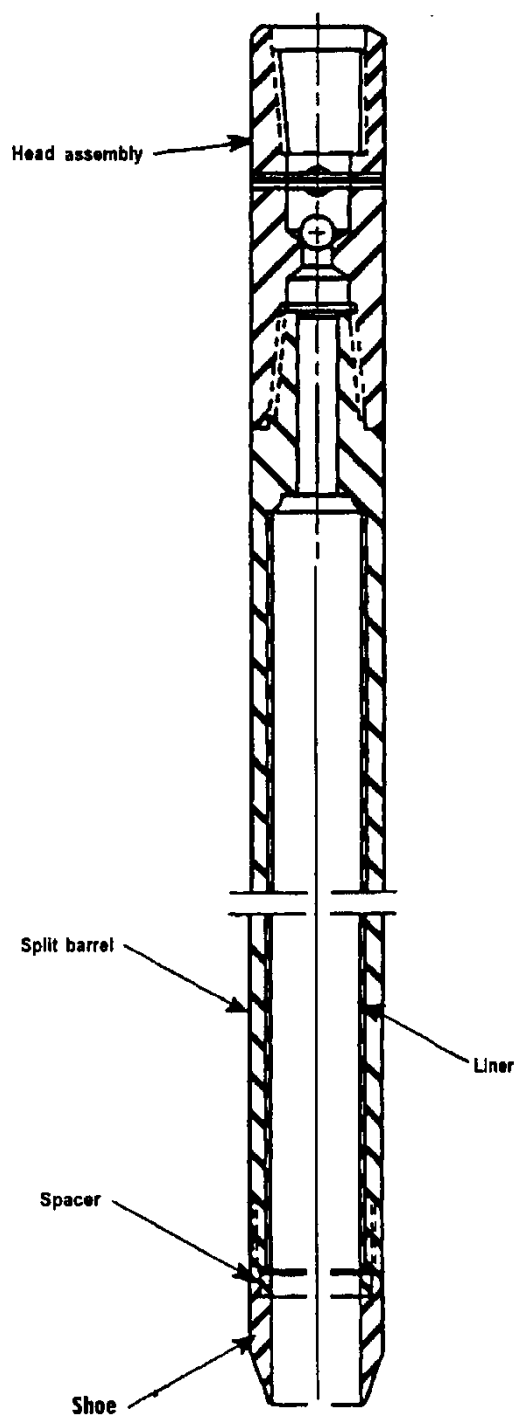
**FIGURE 2**

**TRIER**

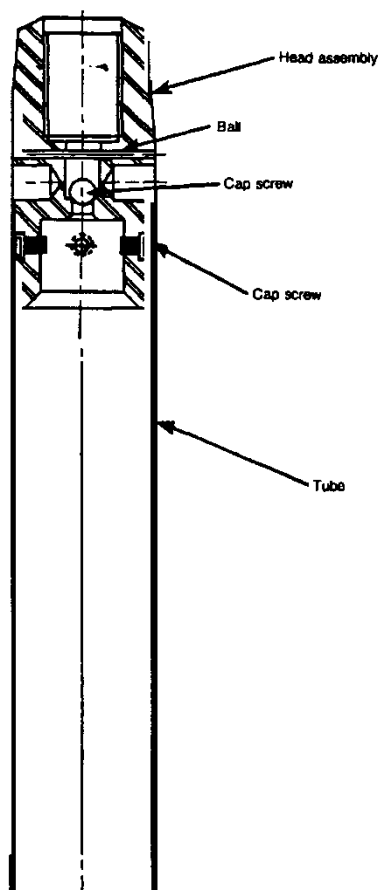
**TRIER**



**FIGURE 3**  
**GENERIC SPLIT-SPOON SAMPLER**



**FIGURE 4**  
**THIN-WALL TUBE SAMPLER**



**SOP APPROVAL FORM**



**PROJECT-SPECIFIC  
ENVIRONMENTAL STANDARD OPERATING PROCEDURE**

**RECORDING NOTES IN FIELD LOGBOOKS**

**SOP NO. 024**

**REVISION NO. 1**

Last Reviewed: December 2013

A handwritten signature in black ink, appearing to read 'John Ruiz'.

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Quality Assurance Approved

04 December 2013

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Date

## **1.0 BACKGROUND**

The field logbook should contain detailed records of all the field activities, interviews of people, and observations of conditions at a site. Entries should be described in as much detail as possible so that personnel can accurately reconstruct, after the fact, activities and events during their performance of field assignments. Field logbooks are considered accountable documents in enforcement proceedings and may be subject to review. Therefore, the entries in the logbook must be accurate and detailed; and they must reflect the importance of the field events.

### **1.1 PURPOSE**

The purpose of this standard operating procedure (SOP) is to provide guidance to ensure that logbook documentation for any field activity is correct, complete, and adequate. Logbooks are used for identifying, locating, labeling, and tracking samples. A logbook should document any deviations from the project approach, work plans, quality assurance project plans, health and safety plans, sampling plans, and any changes in project personnel. They also serve as documentation of any photographs taken during the course of the project. In addition, the data recorded in the logbook may assist in the interpretation of analytical results. A complete and accurate logbook also aids in maintaining good quality control. Quality control is enhanced by proper documentation of all observations, activities, and decisions.

### **1.2 SCOPE**

This SOP establishes the general requirements and procedures for recording notes in the field logbook.

### **1.3 DEFINITIONS**

None

### **1.4 REFERENCES**

Compton, R.R. 1985. *Geology in the Field*. John Wiley and Sons. New York, N.Y.

## **1.5 REQUIREMENTS AND RESOURCES**

The following items are required for field notation:

- Field logbooks
- Ballpoint pens with permanent ink
- 6-inch ruler (optional).

Field logbooks should be bound (sewn) with water-resistant and acid-proof covers; they should have preprinted lines and wide columns. They should be approximately 7 ½ by 4 ½ inches or 8 ½ by 11 inches in size. Loose-leaf sheets are not acceptable for field notes. If notes are written on loose paper, they must be transcribed as soon as possible into a regular field logbook by the same person who recorded the notes.

Logbooks can be obtained from an individual's office supply room or directly from outside suppliers. Logbooks must meet the requirements specified in this SOP and should include preprinted pages that are consecutively numbered. If the numbers must be written by hand, the numbers should be circled so that they are not confused with data.

## **2.0 PROCEDURES**

The following subsections provide general guidelines and formatting requirements for field logbooks, and detailed procedures for completing field logbooks.

### **2.1 GENERAL GUIDELINES**

- A separate field logbook must be maintained for each project. If a site consists of multiple subsites, designate a separate logbook for each subsite. For special tasks, such as periodic well water-level measurements, data from multiple subsites may be entered into one logbook that contains only one type of information.
- All logbooks must be bound and contain consecutively numbered pages.
- No pages can be removed from the logbook for any purpose.

- All field activities, meetings, photographs, and names of personnel must be recorded in the site logbook.
- Each logbook pertaining to a site or subsite should be assigned a serial number based on the date the logbook is issued to the project manager. The first issued logbook should be assigned number 1, the next issued logbook assigned number 2, and so on. The project manager is to maintain a record of all logbooks issued under the project.
- All information must be entered with a ballpoint pen with waterproof ink. Do not use pens with “wet ink,” because the ink may wash out if the paper gets wet. Pencils are not permissible for field notes because information can be erased. The entries should be written dark enough so that the logbook can be easily photocopied.
- Do not enter information in the logbook that is not related to the project. The language used in the logbook should be factual and objective.
- Begin a new page for each day’s notes.
- Write notes on every line of the logbook. If a subject changes and an additional blank space is necessary to make the new subject title stand out, skip one line before beginning the new subject. Do not skip any pages or parts of pages unless a day’s activity ends in the middle of a page.
- Draw a diagonal line on any blank spaces of four lines or more to prevent unauthorized entries.

## **2.2 LOGBOOK FORMAT**

The layout and organization of each field logbook should be consistent with other field logbooks. Guidelines for the cover, spine, and internal pagination are discussed below.

### **2.2.1 FORMAT OF FIELD LOGBOOK COVER AND SPINE**

Write the following information in clear capital letters on the front cover of each logbook using a Sharpie® or similar type permanent ink marker:

- Logbook identification number
- The serial number of the logbook (assigned by the project manager)
- Name of the site, city, and state
- Name of subsite if applicable

- Type of activity
- Beginning and ending dates of activities entered into the logbook
- SulTRAC, City and State
- “REWARD IF FOUND”

Some of the information listed above, such as the list of activities and ending dates, should be entered after the entire logbook has been filled or after decision that the remaining blank pages in the logbook will not be filled.

The spine of the logbook should contain an abbreviated version of the information on the cover: for example, “1, Col. Ave., Hastings, 5/12 - 8/12.”

### **2.2.2 First Page of the Field Logbook**

Spaces are usually provided on the inside front cover (or the opening page in some logbooks), for the company name (SulTRAC), address, contact name, and telephone number. If preprinted spaces for this information are not provided in the logbook, write the information on the first available page.

## **2.3 ENTERING INFORMATION IN THE LOGBOOK**

Enter the following information at the beginning of each day or whenever warranted during the course of a day:

- Date
- Starting time
- Specific location
- General weather conditions and approximate temperature
- Names of personnel present at the site, noting the affiliation(s) and designation(s) of all personnel



- Equipment calibration and equipment models used
- Changes in instructions or activities at the site
- Levels of personal protective clothing and equipment
- A general title of the first task undertaken (for example, well installation at MW-11, decontamination at borehole BH-11, groundwater sampling at MW-11)
- Approximate scale for all diagrams. If this can't be done, write "not to scale" on the diagram. Indicate the north direction on all maps and cross-sections. Label features on each diagram.
- Corrections, if necessary, including a single line through the entry being corrected. Initial and date any corrections made in the logbook.
- After last entry on each page, initials of the person recording notes. No information is to be entered in the area following these initials.
- At the end of the day, signature of the person recording notes and date at the bottom of the last page. Indicate the end of the work day by writing "Left site at (time)." A diagonal line must be drawn across any remaining blank space at the bottom of this last page.

The following information should be recorded in the logbook after taking a photograph:

- Time, date, location, direction, and, if appropriate, weather conditions
- Description of the subject photographed and the reason for taking the picture
- Sequential number of the photograph
- Name of the photographer.

The following information should be entered into the logbook when collecting samples:

- Location description
- Name(s) of sampler(s)
- Collection time
- Designation of sample as a grab or composite sample
- Type of sample (water, sediment, soil gas, etc.)

- On-site measurement data (pH, temperature, specific conductivity)
- Field observations (odors, colors, weather, etc.)
- Preliminary sample description
- Type of preservative used
- Instrument readings

If pre-printed field data forms are available (forms such as the micropurge field data collection form), data should be entered on these pre-printed forms rather than into field logbooks. Note in the logbook that the field data are recorded on separate forms.

## **2.4 PRECAUTIONS**

Custody of field logbooks must be maintained at all times. Field personnel must keep the logbooks in a secure place (locked car, trailer, or field office) when the logbook is not in personal possession.

Logbooks are official project documents and must be treated as such.

**REMEDIAL ACTION CONTRACT 2 FOR  
REMEDIAL, ENFORCEMENT OVERSIGHT, AND  
NON-TIME-CRITICAL REMOVAL ACTIVITIES  
IN REGION 5**

**ATTACHMENT B**

**QUALITY ASSURANCE PROJECT PLAN  
SUPPLEMENTAL REMEDIATION  
CONFIRMATION SAMPLING AND CLEAN FILL SAMPLING  
TRIAX BUILDING AREA**

**OMC PLANT 2 SITE  
WAUKEGAN, LAKE COUNTY, ILLINOIS**

**Prepared for  
U.S. Environmental Protection Agency  
Region 5  
77 West Jackson Boulevard  
Chicago, IL 60604**

Date Submitted:	May 9, 2014
US EPA Region:	5
Work Assignment No:	167-RARA-0528
Contract No:	EP-S5-06-02
Prepared by:	SulTRAC
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## CONTENTS

<b><u>Section</u></b>	<b><u>Page</u></b>
ACRONYMS AND ABBREVIATIONS .....	iii
1.0 INTRODUCTION .....	1
2.0 SITE DESCRIPTION AND HISTORY .....	1
2.1 SITE DESCRIPTION .....	2
2.2 SITE HISTORY .....	2
2.3 OTHER PREVIOUS SITE INVESTIGATIONS .....	2
3.0 QUALITY ASSURANCE PROJECT PLAN PROCEDURES .....	4
QAPP Worksheet #1 Title and Approval Page .....	6
QAPP Worksheet #2 QAPP Identifying Information .....	7
QAPP Worksheet #3 Distribution List.....	13
QAPP Worksheet #4 Project Personnel Sign-Off Sheet .....	14
QAPP Worksheet #5 Project Organization Chart .....	15
QAPP Worksheet #6 Communication Pathways .....	16
QAPP Worksheet #7 Personnel Responsibilities and Qualifications Table .....	17
QAPP Worksheet #8 Special Personnel Training Requirements Table.....	18
QAPP Worksheet #9 Project Scoping Session Participants Sheet .....	19
QAPP Worksheet #10 Problem Definition .....	20
QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements .....	24
QAPP Worksheet #12 Measurement Performance Criteria Table.....	26
QAPP Worksheet #13 Secondary Data Criteria and Limitations Table .....	36
QAPP Worksheet #14 Summary of Project Tasks.....	37
QAPP Worksheet #15 Reference Limits and Evaluation Table .....	39
QAPP Worksheet #16 Project Schedule/Timeline Table.....	45
QAPP Worksheet #17 Sampling Design and Rationale .....	46
QAPP Worksheet #18 Sampling Locations/IDs, Sample Depths, Sample Analyses and Sampling Procedures Table.....	47
QAPP Worksheet #19 Analytical Methods, Containers, Preservatives, and Holding Times Table .....	48
QAPP Worksheet #20 Field Quality Control Sample Summary Table.....	49
QAPP Worksheet #21 Project Sampling SOP References Table .....	50
QAPP Worksheet #22 Field Equipment Calibration, Maintenance, Testing, and Inspection Table.....	51
QAPP Worksheet #23 Analytical SOP References Table .....	52
QAPP Worksheet #24 Analytical Instrument Calibration Table .....	53
QAPP Worksheet #25 Analytical Instrument and Equipment Maintenance Testing, and Inspection Table .....	55

## CONTENTS (Continued)

<b><u>Section</u></b>	<b><u>Page</u></b>
QAPP Worksheet #26 Sample Handling System .....	57
QAPP Worksheet #27 Sample Custody Requirements.....	58
QAPP Worksheet #28 QC Samples Table .....	60
QAPP Worksheet #29 Project Documents and Records Table .....	67
QAPP Worksheet #30 Analytical Services Table .....	68
QAPP Worksheet #31 Planned Project Assessments Table .....	69
QAPP Worksheet #32 Assessment Findings and Corrective Action Responses .....	70
QAPP Worksheet #33 QA Management Reports Table .....	71
QAPP Worksheet #34 Verification (Step I) Process Table .....	72
QAPP Worksheet #35 Validation (Steps IIa and IIb) Process Table .....	73
QAPP Worksheet #36 Validation (Steps IIa and IIb) Summary Table.....	74
QAPP Worksheet #37 Usability Assessment.....	75
REFERENCES .....	77

## FIGURES

- FIGURE 1 SITE LOCATION
- FIGURE 2 REMEDIATION AREAS
- FIGURE 3 CONFIRMATION SAMPLE GRIDS

## ACRONYMS AND ABBREVIATIONS

%D	Percent difference
%R	Percent recovery
ADL	Acceptable detection limit
BOD	Basis of design
bgs	Below ground surface
°C	Degrees Celsius
CA	Corrective action
CAS	Chemical Abstract Services
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
COC	Chain of custody
CPAH	Carcinogenic polynuclear aromatic hydrocarbon
DNAPL	Dense non-aqueous phase liquid
DQI	Data quality indicator
EPA	U. S. Environmental Protection Agency
FS	Feasibility study
FSP	Field sampling plan
GC	Gas chromatography
GC/ECD	Gas chromatography/Electron capture detector
GC/MS	Gas chromatography/mass spectroscopy
HAZWOPER	Hazardous Waste Operations and Emergency Response Standard
IC	Initial calibration
ID	Identification
IEPA	Illinois Environmental Protection Agency
mg/kg	Milligrams per kilogram
MS	Matrix spike
MSD	Matrix spike duplicate
NA	Not applicable
NPL	National Priorities List
NSS	New Smelter Slab
OMC	Outboard Marine Corporation
OSHA	Occupational Safety and Health Administration
OU	Operable Unit

PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
ppm	Parts per million
PQL	Practical quantitation limit
PRQL	Project required quantitation limit
PQO	Project quality objective
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
QL	Quantitation limit
RA	Remedial action
RAC	Remedial Action Contract
RAO	Remedial Action Objective
RD	Remedial design
RI	Remedial investigation
RO	Remediation objective
RPD	Relative percent difference
RRF	Relative response factor
RSD	Relative standard deviation
SAP	Sampling and analysis plan
SOP	Standard operating procedure
SOW	Statement of work
sq. ft.	Square feet
SVOC	Semi-volatile organic compounds
TACO	Tiered Approach to Corrective Action Objective
TBD	To be determined
TCE	Trichloroethene
TCL	Target compound list
TSCA	Toxic Substances Control Act
UFP	Uniform Federal Policy for Implementing Environmental Quality Systems
VOC	Volatile Organic Compound
WA	Work assignment
WAM	Work assignment manager
yd <sup>3</sup>	Cubic yard

## **1.0 INTRODUCTION**

SulTRAC has prepared this quality assurance project plan (QAPP) as part of the sampling and analysis plan (SAP) for Operable Unit (OU) 4 of the Outboard Marine Corporation (OMC) Plant 2 site in Waukegan, Illinois, under the U.S. Environmental Protection Agency (EPA) Remedial Action Contract (RAC) II for Region 5, Contract No. EP-S5-06-02, Work Assignment (WA) No. 153-RARA-167. Under this WA, confirmation soil samples will be collected to obtain the information necessary to determine if remedial action objectives (RAO) have been met as specified in the Basis of Design (CH2M Hill 2008). The SAP consists of the field sampling plan (FSP) (Attachment A) and this QAPP (Attachment B), which are among the site-specific plans to be prepared under the WA in accordance with Task 1 of the EPA statement of work (SOW) (EPA 2009).

This QAPP describes quality assurance (QA) and quality control (QC) protocols and objectives, methods, and procedures to be performed by SulTRAC and its subcontractors during the remedial action (RA) at the OMC Plant 2 site. The scope of the QAPP also includes various field activities of the RA at the OMC Plant 2 Site, which is OU 4 of the OMC Superfund Site.

Section 2.0 of this QAPP describes the site and its history, and Section 3.0 specifies the QAPP procedures. The QAPP worksheets appear after Section 3.0. References used to prepare this QAPP are listed after the worksheets, and figures appear after the list of references.

The primary objective of the soil sampling is to assess compliance with the RAO identified in the Basis of Design. A secondary objective is to characterize concrete for disposal as a Toxic Substances Control Act (TSCA) waste or as non-TSCA waste based on polychlorinated biphenyls (PCB) concentrations. This QAPP addresses various sampling activities associated with this supplemental investigation. Confirmation sampling and sampling of imported fill will be completed during remediation activities in Spring 2014.

## **2.0 SITE DESCRIPTION AND HISTORY**

This section describes the OMC Plant 2 site, summarizes the site's operational history, and describes previous investigations of the site. A more detailed discussion of site background information is in the remedial investigation (RI) report (CH2M Hill 2006a).



## 2.1 SITE DESCRIPTION

Located at 90 East Seahorse Drive in Waukegan, Illinois, about 40 miles north of Chicago, the OMC Plant 2 site is the fourth of four OUs of the OMC site on the National Priorities List (NPL). The OMC site also includes the Waukegan Harbor site (OU 1), the Waukegan Manufactured Gas and Coke Plant (Waukegan Coke Plant) site (OU 2), and the Polychlorinated Biphenyl (PCB) Containment Cells (OU 3). Figure 1 shows the location of the OMC Plant 2 site.

Figure 2 shows the site remediation areas. The site has been largely remediated, and site buildings, slabs, sub-slab soils, and defined remediation areas have been addressed by prior actions. Figure 2 shows the remaining remediation areas—Grid PP-33 and the Triax Building Area.

## 2.2 SITE HISTORY

The OMC Plant 2 site includes a 60-acre lakefront parcel that formerly hosted an abandoned 1,060,000-square-foot industrial facility where OMC made outboard motors from about 1948 until 2000. OMC was the world's largest manufacturer and supplier of outboard motors and the second-largest producer of powerboats. The facility used hydraulic and lubricating oils that contained PCBs in its production lines from 1961 until 1972, and routinely discharged some of the fluids via sewer lines into Waukegan Harbor, thereby becoming the source of very high-level PCB contamination in harbor sediment. OMC also operated several vapor degreasers at the OMC Plant 2 facility to clean newly made parts with trichloroethene (TCE). Leaking degreasers and TCE storage tanks over the years created a plume of TCE in groundwater and a dense non-aqueous phase liquid (DNAPL) plume beneath the OMC Plant 2 site.

OMC declared bankruptcy in December 2000 and ceased all manufacturing operations in August 2001. Much of the OMC site is now owned by the City of Waukegan.

## 2.3 OTHER PREVIOUS SITE INVESTIGATIONS

EPA began the RI at the OMC Plant 2 site in 2004 to delineate the nature and extent of contamination in site groundwater, sediment, soil, and within the OMC Plant 2 building. EPA issued the *Remedial Investigation Report (for) OMC Plant 2*, presenting the study results and a human health and ecological risk assessment in April 2006 (CH2M HILL 2006a). EPA began a feasibility study (FS) in 2005 to examine cleanup alternatives designed to protect human health and the environment, and issued the *Feasibility Study Report (for) OMC Plant 2* in December 2006 (CH2M HILL 2006b).

EPA shared the preliminary RI findings with the City of Waukegan in early 2006, and the City quickly responded by hiring a contractor to demolish the nearly 400,000 square feet of uncontaminated structures down to the concrete slabs beginning in August 2006. Metals were reclaimed for recycling, and the remaining debris was hauled off site and disposed of in a licensed municipal waste landfill. The City, by agreement with EPA, moved PCB-containing electrical transformers from this area into a storage room in the contaminated building, and then EPA disposed of these and almost all other PCB-containing transformers off site at a licensed facility in January 2007. One large PCB-containing transformer remained on the roof of the contaminated building and was addressed during the final building cleanup action in 2010.

SulTRAC completed asbestos abatement and demolition of the existing buildings in 2010 and 2011. In 2011 and 2012, after the Plant 2 structures had been removed, SulTRAC remediated the former building slabs and subslab soils of Plant 2 and the New Smelter Slab (NSS) building area. In addition, sediment in the North Ditch was excavated and later covered with a reactive core mat with anchor and armor materials. In 2012, the off-site waterway was dredged in two areas. Soil in the dunes area was remediated. A TSCA-compliant cap was placed over soil adjacent to the east edge of the east containment cell.

SulTRAC conducted supplemental sampling activities in 2011 to delineate the extent of soil contamination within the NSS area, and also within other areas of the site (SulTRAC 2011a). Results of this sampling were referenced to prepare a Supplemental Design in 2011 (SulTRAC 2011b) that was implemented in 2011 and completed in early 2012.

As part of remediation activities, confirmation samples were collected from the base and sidewalls of each 50- by 50-foot grid. Results of this confirmation sampling indicated presence of PCB contamination beyond the scope of the remedial design (RD). Contamination extended south of the NSS within the area bounded by previously excavated Areas 7, 12, 13, 10, and the Trim Building Slab (which has not yet been remediated).

SulTRAC performed a supplemental investigation in the West Shelf Area to identify the extent of contamination requiring remediation. Samples were collected on a 50-foot grid pattern and at 1-foot depth intervals to establish whether soils met RAOs. The results were presented in a technical memorandum (SulTRAC 2012) and used to develop the Supplemental Design for the West Shelf, East Shelf, and Grid LL-33 areas (SulTRAC 2013b). Supplemental remediation was conducted in the Summer of 2013, which included the removal of soil and concrete to meet RAO within Grid LL-33, the

East Shelf, and West Shelf. A substantial concrete structure was encountered in Grid P-33 that is underlain by TSCA soil (soil contaminated in excess of TSCA standards). This area was not remediated.

SulTRAC conducted confirmation sampling of sidewalls on the west side of the remediation area and additional investigation to the west that including the Triax Building Area and Trim Building Slab as well as Grid PP-33 identified additional soil contamination exceeding RAOs (SulTRAC 2013c). A supplemental design was prepared by SulTRAC to address residual soil contamination in the Triax Building Area, Triax Building Slab, and residual concrete in Grid P-33 (SulTRAC, 2014a).

### **3.0 QUALITY ASSURANCE PROJECT PLAN PROCEDURES**

This QAPP presents procedures that will be used to ensure the quality of data generated for the OMC Plant 2 RA. The QAPP provides a framework for how environmental data will be collected to achieve specific project objectives, and describes procedures that will be implemented to obtain data of known and adequate quality. This QAPP was prepared in accordance with the EPA's "Uniform Federal Policy for Implementing Environmental Quality Systems" (UFP) (EPA 2005).

SulTRAC will perform the following pre-excavation and excavation activities:

- Mobilization and initial activities – This includes establishing work areas as well as central equipment storage and operations areas.
- Sampling of clean backfill to ensure that fill meets the definition of clean fill as described in the Basis of Design (CH2M Hill, 2008). Clean fill must meet the definition of clean fill in accordance with the Tiered Approach to Corrective Action Objective (TACO) remediation objectives (RO) for the Tier I Residential Exposure Route.
- Conduct initial pre-remediation confirmation sampling, using a hydraulic push probe, of subslab soils in grids that were inaccessible to sampling on the Trim Building Slab and in the Boat Crib Area.
- Conduct slab and subslab sampling within the Triax Building, including sampling of concrete cores and subslab soils.
- Removal of residual soil and concrete from Grid PP-33 and from the Trim Building Slab north of the Triax Building. The concrete will be removed, broken up, and stockpiled for off-site disposal.
- Waste characterization and off-site disposal – A composite sample of the concrete and soil will be collected and analyzed for PCBs to determine if the concrete exceeds TSCA criteria.
- Excavation and disposal of contaminated soil from the Triax Building Area – Soil will be excavated from 50- by 50-foot grids at locations where the RAO for PCBs was not met during past sampling. Additional excavation may be conducted to meet TSCA criteria where underlying soils have not been sampled to confirm that they meet TSCA criteria.
- PCB confirmation sampling – Quantify PCB concentrations by collecting composite samples from the sidewalls and base of the excavation areas to confirm that the RAO has been met.

- Carcinogenic polynuclear aromatic hydrocarbon (CPAH) confirmation sampling – In grids where evidence of oily material is encountered during confirmation sampling or excavation, CPAHs may be included as analytes for confirmation sampling.
- Volatile organic compound (VOC) sampling – In grids where evidence of VOC contamination is encountered, such as strong odors and staining accompanied by elevated photoionization detector (PID) readings.

**QAPP WORKSHEET #1  
TITLE AND APPROVAL PAGE**

Quality Assurance Project Plan for Supplemental Remediation Confirmation Sampling and Clean Fill Sampling, Triax Building Area, OMC Plant 2 Site, Waukegan, Illinois

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Document Title

---

SulTRAC

---

Lead Organization

---

Tom Hahne, SulTRAC

---

Preparer's Name and Organizational Affiliation

---

1 South Wacker Drive, Chicago, IL 60606; (312) 201-7474;

---

Preparer's Address, Telephone Number, and E-mail Address

---

Preparation Date (Day/Month/Year)

Signature/Date

E sig and date

---

Tom Hahne

---

SulTRAC Project Manager

Signature/Date

E sig and date

---

John Dirgo

---

SulTRAC QA Officer

Signature/Date

---

Approval Signatures:

---

Tim Drexler, Work Assignment Manager

Signature/Date

Approval Authority

Other Approval Signatures:

---

Michael McDonough, QAPP Reviewer

Signature/Date

**QAPP WORKSHEET #2**  
**QAPP IDENTIFYING INFORMATION**

---

1. Identify guidance used to prepare QAPP:

“Uniform Federal Policy for Implementing Environmental Quality Systems” (UFP) (EPA 2005) and  
“EPA Guidance for Quality Assurance Project Plans” (EPA 2002)

---

2. Identify regulatory program:

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

---

3. Identify approval entity: EPA Region 5

---

4. Indicate whether the QAPP is a generic or project-specific QAPP: Project-specific

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5. List dates of scoping sessions that were held: January 8, 2013

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6. List dates and titles of QAPP documents written for previous work site, if applicable: QAPP, OMC  
Plant 2, Waukegan, IL prepared in September 2009 (SulTRAC 2009a)

---

7. List organizational partners (stakeholders) and connection with lead organization:

EPA Region 5, SulTRAC, Illinois Environmental Protection Agency (IEPA) and City of Waukegan

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8. List data users: EPA Region 5, SulTRAC, IEPA, and City of Waukegan

---

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion below: No field measurements are planned, so Worksheet 22 is not applicable. No assessments are planned, so Worksheets 31 and 32 are not applicable.

---

**QAPP WORKSHEET #2 (CONTINUED)**  
**QAPP IDENTIFYING INFORMATION**

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
Project Management and Objectives		
2.1 - Title and Approval Page	Title and Approval Page	1
2.2 - Document Format and Table of Contents	Table of Contents	
2.2.1 Document Control Format	QAPP Identifying Information	2
2.2.2 Document Control Numbering System		
2.2.3 Table of Contents		
2.2.4 QAPP Identifying Information		
2.3 - Distribution List and Project Personnel Sign-Off Sheet		
2.3.1 Distribution List	Distribution List	3
2.3.2 Project Personnel Sign-Off Sheet	Project Personnel Sign-Off Sheet	4
2.4 - Project Organization		
2.4.1 Project Organization Chart	Project Organization Chart	5
2.4.2 Communication Pathways	Communication Pathways	6
2.4.3 Personnel Responsibilities and Qualifications	Personnel Responsibilities and Qualifications	7
2.4.4 Special Training Requirements and Certification	Special Training Requirements and Certification	8
2.5 - Project Planning/Problem Definition		
2.5.1 Project Planning (Scoping)	Project Planning Session Documentation (including Data Needs tables)	9
	Project Scoping Session Participants Sheet	
2.5.2 Problem Definition, Site History, and Background	Problem Definition, Site History, and Background	10
	Site Maps (present)	Figures 1 to 3

**QAPP WORKSHEET #2 (CONTINUED)**  
**QAPP IDENTIFYING INFORMATION**

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
2.6 - Project Quality Objectives (PQO) and Measurement Performance Criteria		
2.6.1 Development of PQOs Using the Systematic Planning Process	Site-Specific PQOs	11
2.6.2 Measurement Performance Criteria	Measurement Performance Criteria Table	12
2.7 - Secondary Data Evaluation	Sources of Secondary Data and Information	13
	Secondary Data Criteria and Limitations Table	
2.8 - Project Overview and Schedule		
2.8.1 Project Overview	Summary of Project Tasks	14
	Reference Limits and Evaluation Table	15
2.8.2 Project Schedule	Project Schedule/Timeline Table	16
Measurement/Data Acquisition		
3.1 - Sampling Tasks		
3.1.1 Sampling Process Design and Rationale	Sampling Design and Rationale	17
	Sampling Location Map	18, Figures 2 and 3
	Sampling Locations and Methods/Standard Operating Procedures (SOP) Requirements Table	
3.1.2 Sampling Procedures and Requirements		
3.1.2.1 Sampling Collection Procedures	Field Quality Control Sample Summary Table	20
	Sampling SOPs	21, Field Sampling Plan
	Project Sampling SOP References Table	21
3.1.2.2 Sample Containers, Volume, and Preservation	Analytical Methods/SOP Requirements Table	19, 23
3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures	Analytical Methods, Containers, Preservatives, and Holding Times Table	19



**QAPP WORKSHEET #2 (CONTINUED)**  
**QAPP IDENTIFYING INFORMATION**

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures	Field Equipment, Calibration, Maintenance, Testing, and Inspection Procedures Table	22
3.1.2.5 Supply Inspection and Acceptance Procedures		
3.1.2.6 Field Documentation Procedures		
3.2 - Analytical Tasks		
3.2.1 Analytical SOPs	Analytical SOPs	23
	Analytical SOP References Table	
3.2.2 Analytical Instrument Calibration Procedures	Analytical Instrument Calibration Table	24
3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	25
3.2.4 Analytical Supply Inspection and Acceptance Procedures		
3.3 - Sample Collection Documentation, Handling, Tracking, and Custody Procedures	Sample Collection Documentation Handling, Tracking, and Custody SOPs	26
3.3.1 Sample Collection Documentation	Sample Container Identification	26, 27
3.3.2 Sample Handling and Tracking System	Sample Handling Flow Diagram	
3.3.3 Sample Custody	Example Chain-of-Custody Form and Seal	
3.4 - Quality Control (QC) Samples		
3.4.1 Sampling QC Samples	QC Samples Table	28
3.4.2 Analytical QC Samples		
3.5 - Data Management Tasks		
3.5.1 Project Documentation and Records	Project Documents and Records Table	29

**QAPP WORKSHEET #2 (CONTINUED)**  
**QAPP IDENTIFYING INFORMATION**

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
3.5.2 Data Package Deliverables	Analytical Services Table	30
3.5.3 Data Reporting Formats		23 (specified by analytical method), Data Management Plan (SulTRAC 2009b)
3.5.4 Data Handling and Management	Data Management SOPs	
3.5.5 Data Tracking and Control		
Assessment/Oversight		
4.1 - Assessments and Response Actions	Assessments and Response Actions	
4.1.1 Planned Assessments	Planned Project Assessments Table	31
	Audit Checklists	
4.1.2 Assessment Findings and Corrective Action (CA) Responses	Assessment Findings and CA Responses Table	32
4.2 - QA Management Reports	QA Management Reports Table	33
4.3 - Final Project Report		To be determined (TBD)
Data Review		
5.1 - Overview	Not applicable (NA)	NA
5.2 - Data Review Steps		
5.2.1 Step I: Verification	Verification (Step I) Process Table	34
5.2.2 Step II: Validation		
5.2.2.1 Step IIa Validation Activities	Validation (Steps IIa and IIb) Process Table	35
5.2.2.2 Step IIb Validation Activities	Validation (Steps IIa and IIb) Summary Table	36

**QAPP WORKSHEET #2 (CONTINUED)**  
**QAPP IDENTIFYING INFORMATION**

<b>Required QAPP Element(s) and Corresponding QAPP Section(s)</b>	<b>Required Information</b>	<b>QAPP Worksheet # or Crosswalk to Related Documents</b>
5.2.3 Step III: Usability Assessment		
5.2.3.1 Data Limitations and Actions from Usability Assessment	Usability Assessment	37
5.2.3.2 Activities		
5.3 - Streamlining Data Review	NA	NA
5.3.1 Data Review Steps to be Streamlined		
5.3.2 Criteria for Streamlining Data Review		
5.3.3 Amounts and Types of Data Appropriate for Streamlining		

**QAPP WORKSHEET #3**  
**DISTRIBUTION LIST**

<b>QAPP Recipient</b>	<b>Title</b>	<b>Organization</b>	<b>Telephone Number</b>	<b>E-mail Address</b>
Tim Drexler	Work Assignment Manager (WAM)	EPA Region 5	(312) 353-4367	<a href="mailto:drexler.tim@epa.gov">drexler.tim@epa.gov</a>
Michael McDonough	QAPP Reviewer	EPA Region 5	312-886-7336	<a href="mailto:mcdonough.michael@epa.gov">mcdonough.michael@epa.gov</a>
Tom Hahne	Project Manager	SulTRAC	(312) 201-7474	<a href="mailto:tom.hahne@tetrattech.com">tom.hahne@tetrattech.com</a>
Mindy Gould	Project QC Reviewer	SulTRAC	(312) 201-7460	<a href="mailto:mindy.gould@tetrattech.com">mindy.gould@tetrattech.com</a>
John Dirgo	QA Officer	SulTRAC	(312) 201-7765	<a href="mailto:john.dirgo@tetrattech.com">john.dirgo@tetrattech.com</a>
Yonas Miginas	Resident Inspector	SulTRAC	(312) 405-3138	<a href="mailto:ymiginas@onesullivan.com">ymiginas@onesullivan.com</a>
Ann Preston	Laboratory Project Manager	ALS Global	(616) 738-7346	<a href="mailto:ann.preston@ALSGlobal.com">ann.preston@ALSGlobal.com</a>
Adam Certain	Excavation and concrete removal subcontractors	Summit Environmental	(317) 771-5207	<a href="mailto:ACCertain@summitcontracting.net">ACCertain@summitcontracting.net</a>

Notes:

QC      Quality control  
TBD    To be determined  
WAM    Work assignment manager

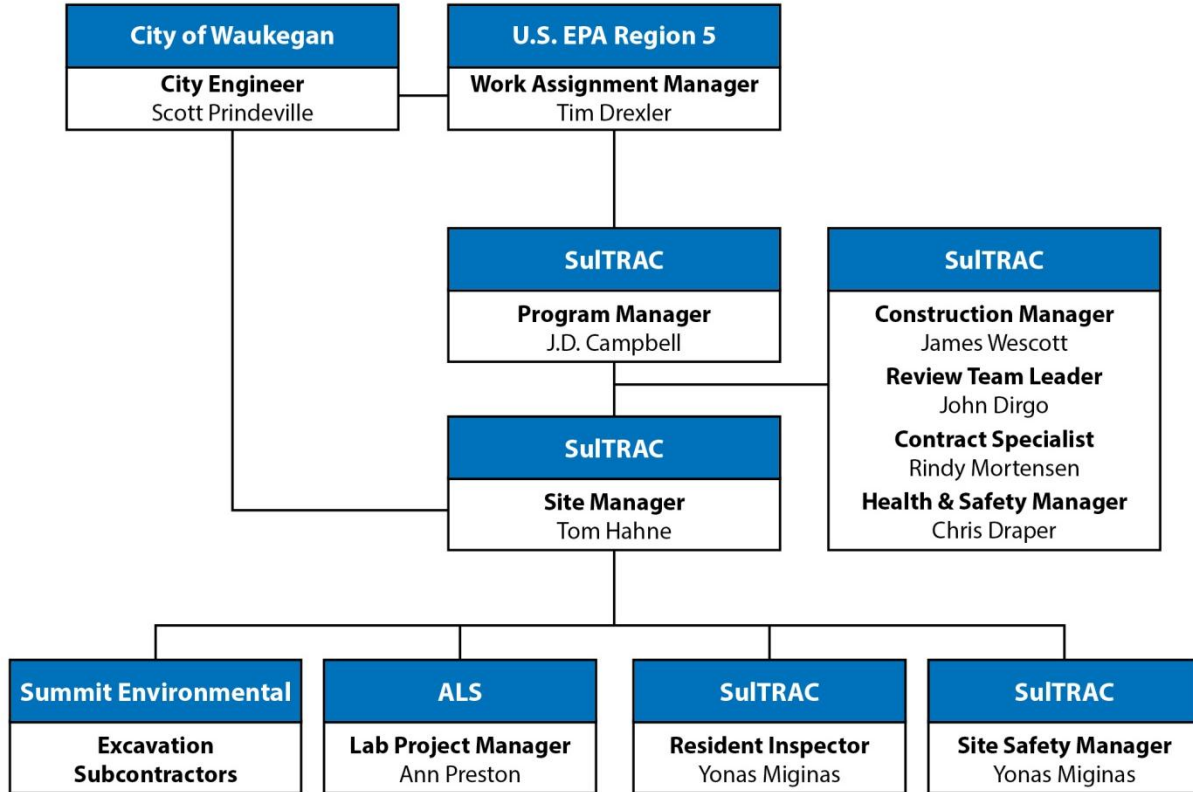
**QAPP WORKSHEET #4**  
**PROJECT PERSONNEL SIGN-OFF SHEET**

<b>Project Personnel</b>	<b>Organization</b>	<b>Title</b>	<b>Telephone No.</b>	<b>Signature</b>	<b>Date QAPP Read</b>
Tom Hahne	SulTRAC	Project Manager	(312) 201-7474		
Mindy Gould	SulTRAC	Project QC Reviewer	(312) 201-7460		
John Dirgo	SulTRAC	QA Officer	(312) 201-7765		
Yonas Miginas	SulTRAC	Resident Inspector	(312) 405-3138		
Ann Preston	Subcontractor Laboratory	Laboratory Project Manager	(616) 738-7346		

Notes:

QA      Quality assurance  
QC      Quality Control  
TBD    To be determined

# QAPP WORKSHEET #5 PROJECT ORGANIZATION CHART



## Notes

EPA: Environmental Protection Agency  
TBD: To be determined

**ORGANIZATIONAL CHART**  
OMC PLANT 2 SITE  
LAKE COUNTY, WAUKEGAN, IL



## QAPP WORKSHEET #6 COMMUNICATION PATHWAYS

Communication Drivers	Responsible Entity	Name	Telephone No.	Procedure (Timing, Pathways, etc.)
Point of contact with EPA WAM	Project Manager	Tom Hahne	(312) 201-7474	Tom Hahne will forward all materials and information about the project to Tim Drexler.
Manage all project phases	Project Manager	Tom Hahne	(312) 201-7474	Communicate information to project team (including subcontractors) on a timely basis. Notify EPA WAM by telephone or e-mail of any significant issues. Direct technical staff and resident engineer, and facilitate communication with analytical coordinator. Deliver all laboratory data packages to project QA reviewer for final validation.
Manage field subcontractors and oversee their activities	Resident Inspector	Yonas Miginas	(312) 405-3138	Conduct inspections and direct field activities of subcontractors, and provide daily communication with project manager.
Point of contact with subcontracted laboratory	Project Manager	Tom Hahne	(312) 201 7474	Contact the subcontractor laboratory before each sampling event to schedule laboratory services. Notify project scientist and project manager of any laboratory issues or developments. Track all laboratory data deliveries. Notify project manager and forward data to him.
Release of analytical data	SulTRAC Project QC Reviewer	Mindy Gould	(312) 201-7460	No analytical data can be released until validation is completed and the QC reviewer has reviewed and approved the release.
Report of laboratory data quality issues	Laboratory Project Manager	Ann Preston	(616) 738-7346	All QA/QC issues with project field samples will be reported by the laboratory project manager to the SulTRAC analytical coordinator.

Notes:

EPA	Environmental Protection Agency
QA	Quality assurance
QC	Quality control
TBD	To be determined
WAM	Work assignment manager

**QAPP WORKSHEET #7**  
**PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS TABLE**

<b>Name</b>	<b>Title</b>	<b>Organization/ Affiliation</b>	<b>Responsibilities</b>	<b>Education and Experience Qualifications</b>
Tom Hahne	Project Manager	SulTRAC	Manages project; coordinates between lead agency and subcontractors; coordinates laboratory data deliverables from analytical coordinator to project quality control (QC) reviewer; manages field staff	B.S. Geology, 28 years of experience
Mindy Gould	Project QC Reviewer	SulTRAC	Project-level quality assurance (QA)/QC oversight	B.S. Environmental Technology and M.S. Environmental Engineering, 29 years of experience
John Dirgo	QA Officer	SulTRAC	RAC program-level QA/QC oversight	B.S. Biology; M.S. and Sc.D. Environmental Health Sciences; 33 years of experience
Yonas Miginas	Resident Inspector	SulTRAC	Supervises all subcontractors performing excavation, site restoration and sampling activities, reports daily to project manager; and conducts inspections and directs field activities of subcontractors.	B.S. Engineering, 5 years of experience

Notes:

QA     Quality assurance  
QC     Quality control  
TBD    To be determined



**QAPP WORKSHEET #8**  
**SPECIAL PERSONNEL TRAINING REQUIREMENTS TABLE**

<b>Project Function</b>	<b>Specialized Training – Title or Description of Course</b>	<b>Training Provider</b>	<b>Training Date</b>	<b>Personnel/Groups Receiving Training</b>	<b>Personnel Titles/ Organizational Affiliation</b>	<b>Location of Training Records/Certificates</b>
Field Staff	40-hour and 8-hour refresher - OSHA HAZWOPER training	Various	Various	SulTRAC	SulTRAC	Corporate human resources office
Subcontractors	40-hour OSHA HAZWOPER training	Various	Various	Excavation and concrete removal subcontractors	TBD	As noted in subcontract agreement – corporate human resources office

Notes:

HAZWOPER Hazardous Waste Operations and Emergency Response Standard  
 OSHA Occupational Safety and Health Administration  
 TBD To be determined

**QAPP WORKSHEET #9**  
**PROJECT SCOPING SESSION PARTICIPANTS SHEET**

Project Name	OMC Plant 2 Site	Site Name	OMC Plant 2 Site		
Projected Date(s) of Sampling	April through June 2014	Site Location	Waukegan, Lake County, Illinois		
Project Manager	Tom Hahne				
Date of Session	January 8, 2013				
Scoping Session Purpose:	Define scope of project				
<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Phone #</b>	<b>E-Mail Address</b>	<b>Project Role</b>
Tim Drexler	WAM	EPA Region 5	(312) 353-4367	<a href="mailto:drexler.tim@epa.gov">drexler.tim@epa.gov</a>	Work Assignment Manager
Tom Hahne	Project Manager	SulTRAC	(312) 201-7474	<a href="mailto:tom.hahne@tetrattech.com">tom.hahne@tetrattech.com</a>	Project Manager
J.D. Campbell	Program Manager	SulTRAC	(312) 443-0550	<a href="mailto:jdcampbell@onesullivan.com">jdcampbell@onesullivan.com</a>	Program Manager

**Comments/Decisions:** WA No. 167-RARA-0528 covers the three phases of remediation activities: 1) removal of soil from the Triax Building Area, 2) import and placement of clean fill and 3) removal of concrete from Grid PP-33 and the Trim Building Slab. This QAPP focuses on sampling related to these remedial activities. SulTRAC will collect confirmation soil and concrete samples after the excavation. Should additional sampling become necessary, this QAPP will be amended appropriately.

## QAPP WORKSHEET #10

### PROBLEM DEFINITION

**The problem to be addressed by the project:** The Outboard Marine Corporation (OMC) Plant 2 site is a 60-acre lakefront parcel containing an abandoned 1,060,000-square-foot industrial facility in which OMC made outboard motors from about 1948 until 2000. The facility used polychlorinated biphenyl (PCB)-containing hydraulic and lubricating oils in its production lines from 1961 until 1972, and routinely discharged some of the fluids via sewer lines into Waukegan Harbor, thereby becoming the source of very high-level PCB contamination in harbor sediment. OMC also operated several vapor degreasers at the OMC Plant 2 facility to clean newly-made parts with trichloroethene (TCE). Leaking degreasers and/or TCE storage tanks over the years created a TCE groundwater contaminant plume and a dense, non-aqueous phase liquid (DNAPL) plume beneath the OMC Plant 2 site. OMC declared bankruptcy in December 2000 and ceased all manufacturing operations in August 2001. Much of the OMC site is now owned by the City of Waukegan.

EPA began a remedial investigation (RI) at the OMC Plant 2 site in 2004 to determine the nature and extent of contamination in site groundwater, sediment, and soil, and within the OMC Plant 2 building. EPA issued the *Remedial Investigation Report (for) OMC Plant 2* containing the study results and a human health and ecological risk assessment in April 2006. EPA began a feasibility study (FS) in 2005 to examine site cleanup alternatives designed to protect human health and the environment, and issued the *Feasibility Study Report (for) OMC Plant 2* in December 2006.

Based on the results of EPA's RI, the City of Waukegan hired a contractor to demolish 400,000 square feet (sq. ft.) of uncontaminated structures down to the concrete slab in August 2006.

In 2010 and 2011, remedial actions (RA) at the OMC site included the following major activities: (1) demolition of the remaining 600,000 sq. ft. of the polychlorinated biphenyl (PCB)-impacted OMC Plant 2 building; (2) asbestos and lead abatement of the building material; (3) excavation of over 200,000 cubic yards (yd<sup>3</sup>) of soil and sediment containing greater than 1 part per million (ppm) PCBs and/or 2 ppm polynuclear aromatic hydrocarbons (PAH); (4) removal of sub-slab concrete associated with the tunnels and airways, and sampling of unsaturated soils and concrete to determine the nature and extent of contamination beneath the building floor; and (5) dredging and dewatering of sediment from North and South Ditches. Remedial actions during 2012 included: (1) excavation of about 15,000 yd<sup>3</sup> of soil and sediment containing PCB concentrations between 1 and 50 milligrams per kilogram (mg/kg); (2) excavation of about 1,000 yd<sup>3</sup> of soil containing PCB concentrations above 50 mg/kg; (3) transportation and disposal of Toxic Substances Control Act (TSCA) and Special Waste soil and sediment; (4) removal, crushing, and on-site placement of 4,500 yd<sup>3</sup> of concrete containing greater than 1 ppm PCBs; (5) installation of a geotextile mat in the North Ditch; (6) extension of the East containment cell cap; and (7) dune restoration.

Additional remedial actions were completed to address the East and West Shelf areas and removal of concrete and associated residual soil in Grid LL-33 with contaminant concentration exceeding TSCA criteria.

Confirmation sampling on the western part of the West Shelf remediation area identified contamination above RAOs; in addition concrete and contaminated soil exceeding TSCA criteria was identified below the water table in Grid PP-33. Supplemental investigation was conducted in 2013 to delineate the extent of contamination (SulTRAC, 2013c). The extent of contamination was largely delineated except for grids that were not accessible to sampling due to the presence of equipment (on the Trim Building Slab) and boat cradles in the area to the southwest of the Triax Building (see Figure 3).

**QAPP WORKSHEET #10 (CONTINUED)**  
**SUMMARY OF PROJECT TASKS**

This Quality Assurance Project Plan (QAPP) pertains to the sampling of imported fill, confirmation sampling in grids that were not sampled during the supplemental remediation, sampling at the base of grids where contaminated soil exceeding TSCA standards is still present, and waste characterization sampling for concrete and soil.

**The environmental questions being asked:**

1. Grid PP-33 – Do PCB concentrations in the concrete removed from this area exceed the TSCA criterion of 50 mg/kg, requiring disposal of the concrete as a TSCA waste?
2. Soil below grids containing TSCA soil – Do PCB concentrations exceed TSCA criterion of 50 mg/kg requiring removal of the soil and disposal as a TSCA waste?
3. Triax Building Area– Prior to excavation, do PCB concentrations in samples from the bases of each unsampled grid exceed the RAO of 1 mg/kg? If evidence of oily materials is noted during confirmation sampling do concentrations of CPAH exceed the RAO of 2 mg/kg? If evidence of VOC contamination is noted does TCE exceed the RAO of 12 mg/kg?
4. Triax Building slab concrete – Do PCB concentrations from cores exceed RAO of 1 mg/kg? If evidence of oily materials is noted during confirmation sampling, do concentrations of CPAH exceed the RAO of 2 mg/kg? If evidence of VOC contamination is noted, does TCE exceed the RAO of 12 mg/kg?
5. Triax Building subslab soils-- Do PCB soil concentrations exceed RAO of 1 mg/kg? If evidence of oily materials is noted during confirmation sampling, do concentrations of CPAH exceed the RAO of 2 mg/kg? If evidence of VOC contamination is noted, does TCE exceed the RAO of 12 mg/kg?
6. Imported Fill material – Does material meet the clean fill definition in accordance with the Basis of Design (BOD) (CH2M Hill 2008)?

**Observations from any site reconnaissance reports:** In accordance with the Supplemental Design, remedial activities were implemented in the West Shelf area after discovery of contamination in the area. The soils were removed to meet RAOs. However, residual contamination that exceeds TSCA criteria is present in one of the grids (Grid PP-33). Grid PP-33 also may contain concrete that exceeds TSCA criteria for PCBs. Supplemental investigation of the Triax Building Area and adjacent Trim Building Slab indicated soil PCB contamination above the RAO. Therefore, this QAPP addresses the remedial activities required to address additional contamination identified in the Grid PP-33, the Triax Building Area, and the Trim Building Slab.

**A synopsis of secondary data or information from site reports:**

SulTRAC conducted supplemental sampling activities in 2013 to delineate the extent of soil contamination within the Triax Building Area; this information is presented in a technical memorandum (SulTRAC, 2013c) and was incorporated into the supplemental design for the Triax Building Area (SulTRAC 2014a). The sampling included sampling within each 50- by 50-foot grid at 1 foot intervals from the ground surface to the presumed groundwater surface (about 5 feet below ground surface). Results of this confirmation sampling indicated presence of PCB contamination exceeding RAOs and the TSCA characteristic for PCBs.

See Worksheet #13 for additional information.

**QAPP WORKSHEET #10 (CONTINUED)**  
**SUMMARY OF PROJECT TASKS**

**The possible classes of contaminants and the affected matrices:** PCBs, CPAHs, and TCE are the contaminants of concern for this investigation, and the affected matrices are soil and concrete. Imported fill must meet the definition of clean fill as presented in the BOD (CH2M Hill, 2008). This includes analysis of Target Compound List compounds.

**Project decision conditions (“If..., then...” statements):** If PCB concentrations in base of excavated grid areas or in previously unsampled grids exceed the RAO of 1 mg/kg, total PCBs, additional excavation will be completed. Excavation and sampling will continue until PCB concentrations in each grid base is below the RAO or the water table is encountered. Results also meet the RAOs if the excavation extends to the groundwater table.

If PCB concentrations in concrete or soil exceed the TSCA regulatory level of 50 mg/kg, (1) the concrete or soil must be disposed of as a TSCA waste, and (2) the soil below the concrete or soil will be sampled and analyzed to determine if PCB concentrations exceed 50 mg/kg, requiring similar disposal.

Do soil samples from each previously unsampled grids in the Triax Building Area exceed the RAO for PCBs of 1 mg/kg? If so, the soil must be removed and disposed of offsite in accordance with disposal criteria (non-TSCA if less than 50 mg/kg but greater than RAO of 1 mg/kg PCBs).

Do soil samples from the subslab soils under the Triax Building exceed the RAO of 1 mg/kg for PCBs? If so, then supplemental remediation activities may be required.

Does concrete from the Triax Building slab exceed the RAO of 1 mg/kg for PCB? If so, then supplemental remediation activities may be required.

If oily material is encountered in previously unsampled grids and CPAH concentrations do not meet the RAO of 2 mg/kg for total CPAH, then additional excavation will be completed until the RAOs are met. Excavation and sampling will continue until CPAH and PCB concentrations are below the RAO or the water table is reached. If evidence of oily material is noted during confirmation sampling or excavation in other grids, CPAHs may be added as analytes for confirmation sampling.

If evidence of VOC contamination is observed and VOC concentrations exceed the RAO of 12 mg/kg, then further evaluation of whether the material should be managed by excavation is necessary. This consideration may include treatment by other methods rather than excavation as discussed in the supplemental RD (SulTRAC, 2014a).

Samples collected for imported clean fill will be compared to TACO Tier I Residential remediation objectives (RO) for the Target Compound List (TCL). The most stringent RO from either the residential ingestion, residential inhalation, construction worker ingestion, construction worker inhalation, or the soil component of the groundwater ingestion exposure route will be used for comparison. Site ROs have been compared to the laboratory’s practical quantitation limits (PQL) and detection limits (DL). The laboratory’s PQLs generally achieve ROs. Where ROs have been revised by the Illinois Environmental Protection Agency (IEPA) to reflect unachievable quantitation limits, an acceptable detection limit (ADL) may be used. In this case the ADL has been identified as the RO for clean fill. In the case where the RO is below the PQL and an ADL has not been adopted, the IEPA has stated that the use of the PQL as the RO is considered acceptable.

**QAPP WORKSHEET #10 (CONTINUED)**  
**SUMMARY OF PROJECT TASKS**

Notes:

ADL	Acceptable detection limit
CPAH	Carcinogenic polynuclear aromatic hydrocarbon
DL	Detection limit
DNAPL	Dense, non-aqueous phase liquid
FS	Feasibility study
mg/kg	Milligrams per kilogram
NSS	New Smelter Slab
OMC	Outboard Marine Corporation
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
ppm	Parts per million
PQL	Practical quantitation limit
QC	Quality control
RAO	Remedial action objective
RI	Remedial investigation
RA	Remedial action
RD	Remedial design
RO	Remediation objective
Sq. ft.	Square foot
TACO	Tiered Approach to Corrective Action Objective per Illinois Administrative Code (IAC), Title 35, Subtitle G, Chapter I, Part 742
TCE	Trichloroethene
TCL	Target compound list
TSCA	Toxic Substances Control Act
yd <sup>3</sup>	Cubic yard

# QAPP WORKSHEET #11

## PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

**Who will use the data:** EPA Region 5, Illinois EPA, SulTRAC, and the City of Waukegan will use the data.

**What will the data be used for?** The data will be used to characterize materials for disposal and to confirm that RAOs have been achieved.

**What type of data are needed (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?**

In the Triax Building Area, samples will be collected at 1 foot intervals for 50- by 50-foot excavation grid where data has not already been obtained. Samples will be collected using a hydraulic push probe. These grid areas are shown in Figure 6 of the Supplemental Design (SulTRAC, 2014a). The grids include:

- RR 24, SS-24, Partial Grid TT-24, Grid SS-25, Partial Grid TT-25 in the Trim Building Slab
- Partial Grid VV-20, Grid WW-20, Grid XX-20, Grid YY-20, and Partial Grid VV-21
- In the Triax Building slab and subslab area, soil samples will be obtained from each grid for concrete and soil at 1 foot intervals

PCB concentrations will be compared to the RAO of 1 mg/kg total PCBs. If oily material is encountered, then CPAH concentrations must also meet the RAO of 2 mg/kg of CPAH. If soil exhibits evidence of VOC contamination, then concentrations of TCE must meet the RAO of 12 mg/kg.

Concrete core samples will be obtained from four cores of concrete obtained from the Triax Building slab. PCB concentrations will be compared to the RAO of 1 mg/kg total PCBs.

In Grid PP-33, one concrete sample will be collected by using a hammer or weight to pulverize the concrete. PCB concentrations in the sample will be compared to the TSCA regulatory limit of 50 mg/kg total PCBs. The soil below the concrete has already been characterized and exceeds TSCA characteristics to a depth of 8 feet below ground surface.

Grid TT-22 has a result in the deepest sample (4 to 5 feet below ground surface) that exceeds the TSCA criterion for PCBs. A composite sample will be collected at the base of the grid. The result will be compared against the TSCA regulatory limit of 50 mg/kg total PCBs. If the result meets the limit no additional excavation will be conducted; otherwise excavation will proceed until results are below the TSCA regulatory limit.

Samples of each imported fill source will be analyzed for Target Compound List (TCL) analytes. Two samples will be obtained from each source of clean fill. The results will be compared to the most stringent TACO Tier I RO for the residential exposure pathways or the reporting limit where the RO is below the reporting limit. The results will either pass or fail for acceptance as clean fill. In addition, if over 3,000 cubic yards of clean fill is received from a source, then an additional sample will be collected for each 3,000 cubic yards. The fill will not be accepted unless it meets the TACO Tier I RO or reporting limit as described above.

All soil and concrete samples will be analyzed by a subcontracted laboratory.

Standard protocols will be used for sample collection, handling, preparation, and analysis. See Worksheets #21 and #23.

**QAPP WORKSHEET #11 (CONTINUED)**  
**PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS**

**How much data is needed (number of samples for each analytical group, matrix, and concentration)?**

It is estimated that about 130 samples may be analyzed for PCBs. This total includes QC samples (see Worksheet #20). Additional samples (estimated at 29) may be collected from other grids and analyzed for CPAHs where evidence of oily material is encountered during excavation or confirmation sampling and/or for VOCs if evidence of VOC contamination is noted.

It is estimated that 8 imported fill samples may be analyzed for TCL analytes.

**Where, when, and how should the data be collected/generated?** See answers above in Worksheets #10 and #11.

**Who will collect and generate the data?** SulTRAC will collect the samples, and analyses will be conducted by a subcontracted laboratory.

**How will the data be reported?** The subcontractor laboratory will use standard data reporting techniques and provide Level 3 data packages. The laboratory used for analysis of TCL analytes will be an EPA approved laboratory.

**How will the data be archived?** Electronic and hard copies of subcontractor laboratory data will be archived by the SulTRAC analytical coordinator. Field data (notebooks, sampling sheets, etc.) will be maintained at SulTRAC's Chicago office. SulTRAC will also provide 10-year data storage.

Notes:

CPAH	Carcinogenic polynuclear aromatic hydrocarbon
EPA	U.S. Environmental Protection Agency
mg/kg	Milligrams per kilogram
PCB	Polychlorinated biphenyl
QC	Quality control
RAO	Remedial action objective
RO	Remediation Objective
TACO	Tiered Approach to Corrective Action Objective per Illinois Administrative Code (IAC), Title 35, Subtitle G, Chapter I, Part 742
TCL	Target Compound List as defined in IAC, Title 35, Subtitle G, Chapter I, Part 740
TSCA	Toxic Substances Control Act
VOC	Volatile Organic Compounds



**QAPP WORKSHEET #12**  
**MEASUREMENT PERFORMANCE CRITERIA TABLE**

<b>Matrix</b>	Soil, Concrete				
<b>Analytical Group</b>	PCBs				
<b>Concentration Level</b>	NA <sup>3</sup>				
<b>Sampling Procedure<sup>1</sup></b>	<b>Analytical Method SOP<sup>2</sup></b>	<b>DQIs</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample and/or Activity Used to Assess Measurement Performance</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&amp;A)</b>
SOP 005-2, FSP Sections 5.3 and 5.4	A-1	Precision	RPD $\leq$ 70%	Field duplicate	S & A
SOP 005-2, FSP Sections 5.3 and 5.4	A-1	Accuracy/Bias	Aroclor-1016: 29-135 %R Aroclor-1260: 29-135 %R	MS/MSD	S & A
SOP 005-2, FSP Sections 5.3 and 5.4	A-1	Precision	Aroclor-1016: 15% RPD Aroclor-1260: 20% RPD	MS/MSD	S & A
SOP 005-2, FSP Sections 5.3 and 5.4	A-1	Accuracy	Decachlorobiphenyl: 30-150 %R, Tetrachloro-m-xylene: 30-150 %R	Surrogate spike	A
SOP 005-2, FSP Sections 5.3 and 5.4	A-1	Accuracy/ Bias-Contamination	PCB < QL	Method blank	A
SOP 005-2, FSP Sections 5.3 and 5.4	A-1	Completeness	$\geq$ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

**QAPP WORKSHEET #12 (CONTINUED)**  
**MEASUREMENT PERFORMANCE CRITERIA TABLE**

<b>Matrix</b>	Soil				
<b>Analytical Group</b>	CPAHs				
<b>Concentration Level</b>	NA <sup>3</sup>				
<b>Sampling Procedure<sup>1</sup></b>	<b>Analytical Method SOP<sup>2</sup></b>	<b>DQIs</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample and/or Activity Used to Assess Measurement Performance</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&amp;A)</b>
SOP 005-2	A-3	Accuracy	Nitrobenzene-d5: 23-120 %R 2-Fluorobiphenyl: 30-115 %R Terphenyl-d14: 18-137 %R	Surrogate spike	A
SOP 005-2	A-3	Accuracy/ Bias-Contamination	PAH < QL	Method blank	A
SOP 005-2	A-3	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

**QAPP WORKSHEET #12 (CONTINUED)**  
**MEASUREMENT PERFORMANCE CRITERIA TABLE**

<b>Matrix</b>	Soil				
<b>Analytical Group</b>	VOCs				
<b>Concentration Level</b>	Low				
<b>Sampling Procedure<sup>1</sup></b>	<b>Analytical Method SOP<sup>2</sup></b>	<b>DQIs</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample and/or Activity Used to Assess Measurement Performance</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&amp;A)</b>
SOP 005-2	A-4	Precision	RPD $\leq$ 70%	Field duplicate	S & A
SOP 005-2	A-4	Accuracy/Bias	1,1-Dichloroethene: 59-172 %R TCE: 62-137 %R Benzene: 66-142 %R Toluene: 59-139 %R Chlorobenzene: 60-133 %R	MS/MSD	S & A
SOP 005-2	A-4	Precision	1,1-Dichloroethene: 22% RPD TCE: 24% RPD Benzene: 21% RPD Toluene: 21% RPD Chlorobenzene: 21% RPD	MS/MSD	S & A
SOP 005-2	A-4	Accuracy	Vinyl chloride-d <sub>3</sub> : 68-122 %R Chloroethane-d <sub>5</sub> : 61-130 %R 1,1-Dichloroethene-d <sub>2</sub> : 45-132 %R 2-Butanone-d <sub>5</sub> : 20-182 %R Chloroform-d: 72-123 %R 1,2-Dichloroethane-d <sub>4</sub> : 79-122 %R Benzene-d <sub>6</sub> : 80-121 %R 1,2-Dichloropropane-d <sub>6</sub> : 74-124 %R Toluene-d <sub>8</sub> : 78-121 %R 1,1,2,2-Tetrachloroethane-d <sub>2</sub> : 56-161 %R Trans-1,3-Dichloropropene-d <sub>4</sub> : 72-130 %R 2-Hexanone-d <sub>5</sub> : 17-184 %R 1,4-Dioxane-d <sub>8</sub> : 50-150 %R 1,2-Dichlorobenzene-d <sub>4</sub> : 70-131 %R	Deuterated monitoring compounds (or surrogates)	A

**QAPP WORKSHEET #12 (CONTINUED)**  
**MEASUREMENT PERFORMANCE CRITERIA TABLE**

<b>Matrix</b>	Soil				
<b>Analytical Group</b>	VOCs				
<b>Concentration Level</b>	Low				
<b>Sampling Procedure<sup>1</sup></b>	<b>Analytical Method SOP<sup>2</sup></b>	<b>DQIs</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample and/or Activity Used to Assess Measurement Performance</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&amp;A)</b>
SOP 005-2	A-4	Accuracy/ Bias-Contamination	VOC < QL	Method blank	A
SOP 005-2	A-4	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

**QAPP WORKSHEET #12 (CONTINUED)**  
**MEASUREMENT PERFORMANCE CRITERIA TABLE**

<b>Matrix</b>	Soil				
<b>Analytical Group</b>	SVOCs				
<b>Concentration Level</b>	Low				
<b>Sampling Procedure<sup>1</sup></b>	<b>Analytical Method SOP<sup>2</sup></b>	<b>DQIs</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample and/or Activity Used to Assess Measurement Performance</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&amp;A)</b>
SOP 005-2	A-3	Precision	RPD $\leq$ 70%	Field duplicate	S & A
SOP 005-2	A-3	Accuracy/Bias	Phenol: 26-90 %R 2-Chlorophenol: 25-102 %R N-Nitroso-di-n-propylamine: 41-126 %R 4-Chloro-3-methylphenol: 26-103 %R Acenaphthene: 31-137 %R 4-Nitrophenol: 11-114 %R 2,4-Dinitrotoluene: 28-89 %R Pentachlorophenol: 17-109 %R Pyrene: 35-142 %R	MS/MSD	S & A
SOP 005-2	A-3	Precision	Phenol: 35% RPD 2-Chlorophenol: 50% RPD N-Nitroso-di-n-propylamine: 38% RPD 4-Chloro-3-methylphenol: 33% RPD Acenaphthene: 19% RPD 4-Nitrophenol: 50% RPD 2,4-Dinitrotoluene: 47% RPD Pentachlorophenol: 47% RPD Pyrene: 36% RPD	MS/MSD	S & A

**QAPP WORKSHEET #12 (CONTINUED)**  
**MEASUREMENT PERFORMANCE CRITERIA TABLE**

<b>Matrix</b>	Soil				
<b>Analytical Group</b>	SVOCs				
<b>Concentration Level</b>	Low				
<b>Sampling Procedure<sup>1</sup></b>	<b>Analytical Method SOP<sup>2</sup></b>	<b>DQIs</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample and/or Activity Used to Assess Measurement Performance</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&amp;A)</b>
SOP 005-2	A-3	Accuracy	Phenol-d5: 17-103 %R Bis(2-Chloroethyl)ether-d8: 12-98 %R 2-Chlorophenol-d4: 13-101 %R 4-Methylphenol-d8: 8-100 %R Nitrobenzene-d5: 16-103 %R 2-Nitrophenol-d4: 16-104 %R 2,4-Dichlorophenol-d3: 23-104 %R 4-Chloroaniline-d4: 1-145 %R Dimethylphthalate-d6: 43-111 %R Acenaphthylene-d8: 20-97 %R 4-Nitrophenol-d4: 16-166 %R Fluorene-d10: 40-108 %R 4,6-Dinitro-2-methylphenol-d2: 1-121 %R Anthracene-d10: 22-98 %R Pyrene-d10: 51-120 %R Benzo(a)pyrene-d12: 43-111 %R	Deuterated monitoring compounds (or surrogates)	A
SOP 005-2	A-3	Accuracy/Bias-Contamination	SVOC < QL	Method blank	A
SOP 005-2	A-3	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S&A

**QAPP WORKSHEET #12 (CONTINUED)**  
**MEASUREMENT PERFORMANCE CRITERIA TABLE**

<b>Matrix</b>	Soil				
<b>Analytical Group</b>	Pesticides				
<b>Concentration Level</b>	NA				
<b>Sampling Procedure<sup>1</sup></b>	<b>Analytical Method SOP<sup>2</sup></b>	<b>DQIs</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample and/or Activity Used to Assess Measurement Performance</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&amp;A)</b>
SOP 005-2	A-5	Precision	RPD $\leq$ 70%	Field duplicate	S & A
SOP 005-2	A-5	Accuracy/Bias	gamma-BHC (Lindane): 56-123 %R Heptachlor: 40-131 %R Aldrin: 40-120 %R Dieldrin: 52-126 %R Endrin: 56-121 %R 4,4'-DDT: 38-127 %R	MS/MSD	S & A
SOP 005-2	A-5	Precision	gamma-BHC (Lindane): 15 %RPD Heptachlor: 20 %RPD Aldrin: 22 %RPD Dieldrin: 18 %RPD Endrin: 21 %RPD 4,4'-DDT: 27 %RPD	MS/MSD	S & A
SOP 005-2	A-5	Accuracy	Tetrachloro-m-xylene: 30-150 %R Decachlorobiphenyl: 30-150 %R	Surrogate spike	A
SOP 005-2	A-5	Accuracy/ Bias-Contamination	Pesticide < QL	Method blank	A
SOP 005-2	A-5	Accuracy/Bias	gamma-BHC (Lindane): 50-120 %R Heptachlor epoxide: 50-150 %R Dieldrin: 30-130 %R 4,4'-DDE: 50-150 %R Endrin: 50-120 %R Endosulfan sulfate: 50-120 %R gamma-Chlordane: 30-130%R	LCS	A

**QAPP WORKSHEET #12 (CONTINUED)**  
**MEASUREMENT PERFORMANCE CRITERIA TABLE**

<b>Matrix</b>	Soil				
<b>Analytical Group</b>	Pesticides				
<b>Concentration Level</b>	NA				
<b>Sampling Procedure<sup>1</sup></b>	<b>Analytical Method SOP<sup>2</sup></b>	<b>DQIs</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample and/or Activity Used to Assess Measurement Performance</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&amp;A)</b>
SOP 005-2	A-5	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A



**QAPP WORKSHEET #12 (CONTINUED)**  
**MEASUREMENT PERFORMANCE CRITERIA TABLE**

<b>Matrix</b>	Soil				
<b>Analytical Group</b>	Metals (including mercury, selenium, and cyanide)				
<b>Concentration Level</b>	NA				
<b>Sampling Procedure<sup>1</sup></b>	<b>Analytical Method SOP<sup>2</sup></b>	<b>DQIs</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample and/or Activity Used to Assess Measurement Performance</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&amp;A)</b>
SOP 005-2	A-6, A-7, A-9	Precision	$RPD \leq 70\%$	Field duplicate	S & A
SOP 005-2	A-6, A-7, A-9	Accuracy/Bias	All metals and cyanide: 75-125 %R	Matrix spike	A
SOP 005-2	A-6, A-7, A-9	Precision	All metals and cyanide: < 20% RPD	Laboratory duplicate	A
SOP 005-2	A-6, A-7, A-9	Accuracy/Bias, Contamination	Metals < QL	Method blank	A
SOP 005-2	A-6, A-7, A-9	Completeness	$\geq 90\%$	Data completeness defined as data not qualified as rejected after validation	S & A

**QAPP WORKSHEET #12 (CONTINUED)**  
**MEASUREMENT PERFORMANCE CRITERIA TABLE**

<b>Matrix</b>	Soil				
<b>Analytical Group</b>	pH				
<b>Concentration Level</b>	NA				
<b>Sampling Procedure<sup>1</sup></b>	<b>Analytical Method SOP<sup>2</sup></b>	<b>DQIs</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample and/or Activity Used to Assess Measurement Performance</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&amp;A)</b>
SOP 005-2	A-10	Precision	< 20% RPD	Laboratory duplicate	A
SOP 005-2	A-10	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

Notes:

The measurement performance criteria listed are based on those given in the EPA Contract Laboratory Program (CLP) statements of work and related documents. Once a laboratory is subcontracted, laboratory-specific criteria, if similar or more restrictive, will be substituted for the listed criteria.

<sup>1</sup> Reference number from QAPP Worksheet #21. The sampling procedures are provided in Appendix A of the FSP (SulTRAC 2014b).

<sup>2</sup> Reference number from QAPP Worksheet #23

<sup>3</sup> Not applicable

%R Percent recovery  
CPAH Carcinogenic polynuclear aromatic hydrocarbon  
DQI Data quality indicator  
MS/MSD Matrix spike/matrix spike duplicate  
NA Not applicable  
PAH Polynuclear aromatic hydrocarbon  
PCB Polychlorinated biphenyl  
QL Quantitation limit  
RPD Relative percent difference  
SOP Standard Operating Procedure  
SVOC Semivolatile organic compound  
VOC Volatile organic compound

**QAPP WORKSHEET #13**  
**SECONDARY DATA CRITERIA AND LIMITATIONS TABLE**

<b>Secondary Data</b>	<b>Data Source (Originating Organization, Report Title, and Date)</b>	<b>Data Source (Originating Org, Data Types, data Generation/ Collection Dates)</b>	<b>How data will be used</b>	<b>Limitation on Data Use</b>
Soil contamination data	Supplemental Investigation, Triax Building Area	SulTRAC 2013e	This data will determine waste characterization for soil and also determine limits of excavation.	Some grids have not been sampled and will have to be samples as part of the remediation activities.

Notes:

NA      Not applicable

## **QAPP WORKSHEET #14**

### **SUMMARY OF PROJECT TASKS**

#### **Sampling Tasks:**

SulTRAC and the subcontractor will perform the following activities:

- (1) Identify and sample clean fill source(s).
- (2) Survey each grid location.
- (3) Conduct push probe sampling of soils in unsampled grids in Triax Building Area.
- (4) Conduct concrete coring of slab and push probe sampling of subslab soils below Triax Building.
- (5) Remove concrete from the Trim Building Slab.
- (6) Collect confirmation samples from unsampled grids and determine if PCB concentrations are below the RAO
- (7) Excavate soil in Triax Building Area.
- (8) Remove concrete from Grid PP-33 and characterize concrete as TSCA or non-TSCA.
- (9) Remove TSCA soil from Grid PP-33.
- (10) Transport and dispose of soil and concrete as Subtitle D (non-hazardous) or TSCA waste.
- (11) Backfill and restore the excavated areas.

#### **Analysis Tasks:**

The subcontracted laboratory will analyze soil and concrete samples for PCBs using SW-846 Method 8082A. Soil samples will also be analyzed for CPAHs using SW-846 Method 8270D. Clean Fill will be analyzed for the TCL in accordance with the methods identified below:

Volatile Organic Compounds – SW-846 Method 8260 B

Semivolatile Organic Compounds – SW-846 Method 8270D

Pesticide Compounds – SW-846 Method 8081A

PCBs – SW-846 Method 8082A

Metals and cyanide:

- All metals except mercury– SW-846 Method 6020A
- Mercury – SW-846 Method 7471A
- Cyanide -- SW-846 Method 9012A
- Soil pH – SW-846 Method 9045D

## QAPP WORKSHEET #14 (CONTINUED)

### SUMMARY OF PROJECT TASKS

<b>QC Tasks:</b> The following QC samples will be collected and analyzed during the sampling for PCBs or other parameters: field duplicates and matrix spike (MS)/matrix spike duplicate (MSD) samples. QC samples are described on Worksheet #20.
<b>Secondary Data:</b> See Worksheet #13
<b>Data Management Tasks:</b> Analytical data will be entered into a database after having been validated. The data will then be used for mapping, figures, and reporting.
<b>Documentation and Records:</b> All samples collected will be documented in a logbook using a ballpoint pen. The time of collection, identification number, sampling location, field observations, sampler's name, and analyses will be recorded in the logbook for each sample. Each page of the logbook will be dated, numbered, and signed by SulTRAC personnel. Field data records will be maintained at SulTRAC's Chicago office. SulTRAC will follow custody procedures outlined in Worksheet #27 and Section 8.5 of the FSP. Further specifications are described in the FSP (SulTRAC 2014b).
<b>Assessment/Audit Tasks:</b> No field or laboratory audits are currently planned.
<b>Data Review Tasks:</b> The SulTRAC analytical coordinator or a SulTRAC chemist will complete a limited validation of data generated by the subcontracted laboratory.

Notes:

CPAH	Carcinogenic polynuclear aromatic hydrocarbon
FSP	Field sampling plan
mg/kg	Milligrams per kilogram
MS/MSD	Matrix spike/matrix spike duplicate
PCB	Polychlorinated biphenyl
QC	Quality control
RAO	Remedial action objective
TCL	Target compound limit
TSCA	Toxic Substances Control Act

## QAPP WORKSHEET #15 REFERENCE LIMITS AND EVALUATION TABLE

**Reference Limits Table – Soil/Concrete, Total Analyses**

Analytical Group	Analyte	CAS Number	PRQL – Soil, concrete (mg/kg) <sup>1</sup>	Project Action Limit – Soil/Concrete (mg/kg) <sup>2</sup>
PCB	Aroclor-1016	12674-11-2	0.0833	1.0 / 50.0
PCB	Aroclor-1221	11104-28-2	0.0833	1.0 / 50.0
PCB	Aroclor-1232	11141-16-5	0.0833	1.0 / 50.0
PCB	Aroclor-1242	53469-21-9	0.0833	1.0 / 50.0
PCB	Aroclor-1248	12672-29-6	0.0833	1.0 / 50.0
PCB	Aroclor-1254	11097-69-1	0.0833	1.0 / 50.0
PCB	Aroclor-1260	11096-82-5	0.0833	1.0 / 50.0
PCB	Aroclor-1268	11100-14-4	0.0833	1.0 / 50.0
CPAH <sup>3</sup>	Benzo(a)anthracene	56-55-3	0.00667	2.0
CPAH <sup>3</sup>	Benzo(b)fluoranthene	205-99-2	0.00667	2.0
CPAH <sup>3</sup>	Benzo(k)fluoranthene	207-08-9	0.00667	2.0
CPAH <sup>3</sup>	Benzo(a) pyrene	50-32-8	0.00667	2.0
CPAH <sup>3</sup>	Benzo(g,h,i) perylene	191-24-2	0.00667	2.0
CPAH <sup>3</sup>	Dibenzo(a,h)anthracene	53-70-3	0.00667	2.0
CPAH <sup>3</sup>	Dibenzofuran	132-64-9	0.160	2.0
CPAH <sup>3</sup>	Indeno(1,2,3,-cd)pyrene	193-39-5	0.00667	2.0
CPAH <sup>3</sup>	Naphthalene	91-20-3	0.00667	2.0

Notes:

CAS            Chemical Abstract Services  
 CPAH        Carcinogenic polynuclear aromatic hydrocarbon  
 PRQL        Project-required quantitation limit (ALS Laboratory reporting limit)  
 mg/kg        Milligrams per kilogram  
 PCB         Polychlorinated biphenyl

<sup>1</sup>            The PRQLs listed are the ALS laboratory reporting limits for PCBs in soil.

<sup>2</sup>            Project action limits are (1) the remedial action objectives in the Supplemental Design Report (SulTRAC 2013b) and (2) the regulatory limit for TSCA wastes.

<sup>3</sup>            The list of CPAH is obtained from the CH2M Hill Basis of Design report (CH2M Hill 2008).

**QAPP WORKSHEET #15 - CONTINUED**  
**REFERENCE LIMITS AND EVALUATION TABLE**

**Reference Limits Table – Clean Fill**

<b>Analytical Group</b>	<b>Analyte</b>	<b>CAS Number</b>	<b>PRQL – Soil (mg/kg)<sup>1</sup></b>	<b>Project Action Limit – Soil (mg/kg)<sup>2</sup></b>
VOC	Acetone	67-64-1	0.01	25
VOC	Benzene	71-43-2	0.005	0.03
VOC	Bromodichloromethane	75-27-4	0.005	0.6
VOC	Bromoform	75-25-2	0.005	0.8
VOC	Bromomethane	74-83-9	0.01	0.2
VOC	2-Butanone	78-93-3	0.01	17
VOC	Carbon disulfide	75-15-0	0.005	9
VOC	Carbon tetrachloride	56-23-5	0.005	0.07
VOC	Chlorobenzene	108-90-7	0.005	1
VOC	Chloroethane	75-00-3	0.005	39
VOC	Chloroform	67-66-3	0.005	0.3
VOC	Chloromethane	74-87-3	0.01	110
VOC	Dibromochloromethane	124-48-1	0.005	0.4
VOC	1,1-Dichloroethane	75-34-3	0.005	23
VOC	1,2-Dichloroethane	107-06-2	0.005	0.02
VOC	1,1-Dichloroethene	75-35-4	0.005	0.06
VOC	cis-1,2-Dichloroethene	156-59-2	0.005	0.4
VOC	trans-1,2-Dichloroethene	156-60-5	0.005	0.7
VOC	1,2-Dichloropropane	78-87-5	0.005	0.03
VOC	cis-1,3-Dichloropropene	10061-01-5	0.005	0.4
VOC	trans-1,3-Dichloropropene	10061-02-6	0.01	0.4
VOC	Ethylbenzene	100-41-4	0.00019	13
VOC	2-Hexanone	591-78-6	0.005	0.16
VOC	Methylene chloride	108-10-1	0.005	0.02
VOC	Methyl tert-butyl ether	1634-04-4	0.005	0.32
VOC	Styrene	100-42-5	0.005	4
VOC	1,1,2,2-Tetrachloroethane	79-34-5	0.005	0.62
VOC	Tetrachloroethene	127-18-4	0.005	0.06
VOC	Toluene	108-88-3	0.005	12
VOC	1,1,1-Trichloroethane	71-55-6	0.005	2
VOC	1,1,2-Trichloroethane	79-00-5	0.005	0.02
VOC	Trichloroethene	79-01-6	0.005	0.06
VOC	Vinyl chloride	75-01-4	0.005	0.01

**QAPP WORKSHEET #15 (CONTINUED)**  
**REFERENCE LIMITS AND EVALUATION TABLE**

Analytical Group	Analyte	CAS Number	PRQL – Soil (mg/kg) <sup>1</sup>	Project Action Limit – Soil (mg/kg) <sup>2</sup>
VOC	Xylenes, Total	1330-20-7	0.01	5.6
SVOC	Acenaphthene	83-32-9	0.00667	570
SVOC	Acenaphthylene	208-96-8	0.00667	85
SVOC	Anthracene	120-12-7	0.00667	12,000
SVOC	Benz(a)anthracene	56-55-3	0.00667	0.9
SVOC	Benzo(a)pyrene	50-32-8	0.00667	0.09
SVOC	Benzo(b)fluoranthene	205-99-2	0.00667	0.9
SVOC	Benzo(g,h,i)perylene	191-24-2	0.00667	2,300
SVOC	Benzo(k)fluoranthene	207-08-9	0.00667	9
SVOC	Chrysene	218-01-9	0.00667	88
SVOC	Dibenz(a,h)anthracene	53-70-3	0.00667	0.09
SVOC	Fluoranthene	206-44-0	0.00667	3,100
SVOC	Fluorene	86-73-7	0.00667	560
SVOC	Indeno(1,2,3-cd)pyrene	193-39-5	0.00667	0.9
SVOC	Naphthalene	91-20-3	0.00667	1.8
SVOC	Phenanthrene	85-01-8	0.00667	210
SVOC	Pyrene	129-00-0	0.00667	2,300
SVOC	Aniline	65-85-0	0.660	0.660*
SVOC	Benzidine	100-51-6	0.660	0.660*
SVOC	Benzoic acid	111-91-1	0.100	400
SVOC	Benzyl alcohol	111-44-4	0.660	3
SVOC	Bis(2-chloroethoxy)methane	117-81-7	0.160	2
SVOC	Bis(2-chloroethyl)ether	85-68-7	0.160	0.660**
SVOC	Bis(2-ethylhexyl)phthalate	86-74-8	0.330	46
SVOC	Butyl benzyl phthalate	106-47-8	0.160	930
SVOC	Carbazole	91-58-7	0.160	0.6
SVOC	4-Chloroaniline	95-57-8	0.660	0.7
SVOC	4-Chloro-3-methylphenol	59-50-7	0.160	NE
SVOC	2-Chloronaphthalene	132-64-9	0.00667	49
SVOC	2-Chlorophenol	95-50-1	0.160	4
SVOC	Dibenzofuran	106-46-7	0.160	3
SVOC	1,2-Dichlorobenzene	91-94-1	0.160	17
SVOC	1,4-Dichlorobenzene	120-83-2	0.160	2
SVOC	3,3'-Dichlorobenzidine	84-66-2	0.660	1.3**
SVOC	2,4-Dichlorophenol	65-85-0	0.160	1



**QAPP WORKSHEET #15 (CONTINUED)**  
**REFERENCE LIMITS AND EVALUATION TABLE**

Analytical Group	Analyte	CAS Number	PRQL – Soil (mg/kg) <sup>1</sup>	Project Action Limit – Soil (mg/kg) <sup>2</sup>
SVOC	Diethyl phthalate	100-51-6	0.330	470
SVOC	2,4-Dimethylphenol	105-67-9	0.330	9
SVOC	Dimethyl phthalate	131-11-3	0.330	20,000
SVOC	2,4-Dinitrophenol	51-28-5	0.660	0.660*
SVOC	4,6-Dinitro-2-methylphenol	534-52-1	0.330	NE
SVOC	2,4-Dinitrotoluene	121-14-2	0.160	0.250**
SVOC	2,6-Dinitrotoluene	606-20-2	0.160	0.260**
SVOC	Di-n-butyl phthalate	84-74-2	0.330	2,300
SVOC	Di-n-octyl phthalate	117-84-0	0.160	1,600
SVOC	Hexachlorobenzene	118-74-1	0.160	2
SVOC	Hexachlorobutadiene	87-68-3	0.160	2.2
SVOC	Hexachlorocyclopentadiene	77-47-4	0.330	1.1
SVOC	Hexachloroethane	67-72-1	0.160	0.5
SVOC	Isophorone	78-59-1	0.160	8
SVOC	2-Methylnaphthalene	91-57-6	0.00667	1.9
SVOC	2-Methylphenol	95-48-7	0.160	15
SVOC	4-Methylphenol	106-44-5	0.160	3.9
SVOC	2-Nitroaniline	88-74-4	0.660	0.7
SVOC	3-Nitroaniline	99-09-2	0.660	0.7
SVOC	4-Nitroaniline	100-01-6	0.660	0.660*
SVOC	2-Nitrophenol	88-75-5	0.160	NE
SVOC	Nitrobenzene	98-95-3	0.160	0.160*
SVOC	4-Nitrophenol	100-02-07	0.660	NE
SVOC	N-Nitrosodi-n-propylamine	621-64-7	0.160	0.160*
SVOC	N-Nitrosodimethylamine	62-75-9	0.160	0.160*
SVOC	N-Nitrosodiphenylamine	86-30-6	0.160	1
SVOC	Pentachlorophenol	87-86-5	0.330	0.330*
SVOC	Phenol	108-95-2	0.160	100
SVOC	Pyridine	110-86-1	0.160	NE
SVOC	1,2,4-Trichlorobenzene	120-82-1	0.160	0.5
SVOC	2,4,5-Trichlorophenol	95-95-4	0.160	270
SVOC	2,4,6-Trichlorophenol	88-06-2	0.160	0.2

**QAPP WORKSHEET #15 (CONTINUED)**  
**REFERENCE LIMITS AND EVALUATION TABLE**

<b>Analytical Group</b>	<b>Analyte</b>	<b>CAS Number</b>	<b>PRQL – Soil (mg/kg)<sup>1</sup></b>	<b>Project Action Limit – Soil (mg/kg)<sup>2</sup></b>
Metals and Cyanide	Aluminum	7429-90-5	0.5	78,000
Metals and Cyanide	Antimony	7440-36-0	0.25	5
Metals and Cyanide	Arsenic	7440-38-2	0.25	13
Metals and Cyanide	Barium	7440-39-3	0.25	1,700
Metals and Cyanide	Beryllium	7440-41-7	0.1	140
Metals and Cyanide	Cadmium	7440-43-9	0.1	11
Metals and Cyanide	Calcium	7440-70-2	25	NE
Metals and Cyanide	Chromium	7440-47-3	0.25	36
Metals and Cyanide	Cobalt	7440-48-4	0.25	1
Metals and Cyanide	Copper	7440-50-8	0.25	2,900
Metals and Cyanide	Cyanide	57-12-5	0.5	40
Metals and Cyanide	Iron	7439-89-6	4	NE
Metals and Cyanide	Lead	7439-92-1	0.25	107
Metals and Cyanide	Magnesium	7439-95-4	10	325,000
Metals and Cyanide	Manganese	7439-96-5	0.25	1,600
Metals and Cyanide	Mercury	7439-97-6	0.02	0.1/3.3
Metals and Cyanide	Nickel	7440-02-0	0.25	180
Metals and Cyanide	Potassium	7440-09-7	10	NE
Metals and Cyanide	Selenium	7782-49-2	0.25	4.5
Metals and Cyanide	Sodium	7440-23-5	10	NE
Metals and Cyanide	Silver	7440-22-4	0.25	13
Metals and Cyanide	Thallium	7440-28-0	0.25	3
Metals and Cyanide	Vanadium	7440-62-2	0.25	550
Metals and Cyanide	Zinc	7440-66-6	0.5	7,500
Pesticides	Alpha-BHC	319-84-6	0.010	0.010*
Pesticides	Beta-BHC	319-85-7	0.010	NE
Pesticides	Delta-BHC	319-86-8	0.010	NE
Pesticides	Gamma-BHC	58-89-9	0.010	0.010*
Pesticides	Heptachlor	76-44-8	0.010	0.871**
Pesticides	Aldrin	309-00-2	0.010	0.04
Pesticides	Heptachlor expoxide	1024-57-3	0.010	0.07
Pesticides	Endosulfan I	959-98-8	0.010	18
Pesticides	Dieldrin	60-57-1	0.010	0.004
Pesticides	4-4'-DDE	72-55-9	0.010	2
Pesticides	Endrin	72-20-8	0.010	1

**QAPP WORKSHEET #15 (CONTINUED)**  
**REFERENCE LIMITS AND EVALUATION TABLE**

Analytical Group	Analyte	CAS Number	PRQL – Soil (mg/kg) <sup>1</sup>	Project Action Limit – Soil (mg/kg) <sup>2</sup>
Pesticides	Endosulfan II	33213-65-9	0.010	18
Pesticides	4-4'-DDD	72-54-8	0.010	16
Pesticides	Endosulfan sulfate	1031-07-8	0.010	NE
Pesticides	4-4'-DDT	50-29-3	0.010	2
Pesticides	Methoxychlor	72-43-5	0.010	160
Pesticides	Endrin ketone	53494-70-5	0.010	NE
Pesticides	Endrin aldehyde	7421-93-4	0.010	NE
Pesticides	Alpha-Chlordane	5103-71-9	0.010	NE
Pesticides	Gamma-Chlordane	5566-34-7	0.010	NE
Pesticides	Toxaphene	Toxaphene	0.060	0.6
PCBs	Arochlor-1016	12674-11-2	0.0833	1
PCBs	Arochlor-1221	11104-28-2	0.0833	1
PCBs	Arochlor-1232	11141-16-5	0.0833	1
PCBs	Arochlor-1242	53469-21-9	0.0833	1
PCBs	Arochlor-1248	12672-29-6	0.0833	1
PCBs	Arochlor-1254	11097-69-1	0.0833	1
PCBs	Arochlor-1260	111096-82-5	0.0833	1

Notes:

- <sup>1</sup> Project Required Quantitation Limit (ALS laboratory reporting limit)
- <sup>2</sup> Project action limit is specified as the most stringent Tiered Approach to Corrective Action Objective (TACO) remediation objective (RO) based on the Residential Exposure Pathway listed in Part 742 Appendix B of the Illinois Administrative Code. The Illinois Environmental Protection Agency (IEPA) has issued acceptable detection limits (ADL) for some analytes with very low ROs to reflect unachievable quantitation limits. Where the TACO RO is below both the laboratory reporting limit and the ADL, IEPA has stated that the laboratory reporting limit is acceptable as the project action limit. Analytes where the laboratory reporting limit is used as the project action limit are indicated by (\*); analytes where an ADL is used as the project action limit are indicated by (\*\*).
- CAS Chemical Abstract Services
- CPAH Carcinogenic polynuclear aromatic hydrocarbon
- PRQL Project-required quantitation limit (ALS laboratory reporting limit)
- mg/kg Milligrams per kilogram
- NE Not established
- PAL Project Action Limit
- PCB Polychlorinated biphenyl
- PHS pH specific remedial objectives based on TACO (Part 742 Appendix B, Table C)
- PRQL The project required quantitation limit are specified as the method reporting limits per required analytical method
- SVOC Semivolatile organic compounds
- VOC Volatile organic compounds

**QAPP WORKSHEET #16**  
**PROJECT SCHEDULE/TIMELINE TABLE**

Activity	Organization	Date		Deliverable	Deliverable Due Date
		Anticipated Date of Initiation	Anticipated Date of Completion		
Clean Fill Source	SulTRAC	May 2014	June 2014	FSP and QAPP	April 2014
Waste Characterization	SulTRAC	May 2014	May 2014	FSP and QAPP	April 2014
Confirmation Sampling	SulTRAC	May 2014	June 2014	FSP and QAPP	April 2014
Data evaluation	SulTRAC	May 2014	July 2014	Remedial Action Report	August 2014

Notes:

FSP     Field Sampling Plan  
QAPP    Quality Assurance Project Plan

## QAPP WORKSHEET #17 SAMPLING DESIGN AND RATIONALE

**Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be collected, and the sampling frequency (including seasonal considerations). (May refer to map or Worksheet #18 for details).**

During the RA, SulTRAC will collect soil and concrete samples from Grid PP-33, the Trim Building Slab, the Triax Building Area, and the Triax Building slab and subslab soils. Sample locations are shown on Figures 2 and 3. All samples will be analyzed for PCBs by a subcontracted laboratory. A total of about 144 soil samples and 7 concrete samples will be collected (these totals include QC samples). Sample collection procedures for soil and concrete are as follows:

- PCB confirmation sampling: Soil samples will be collected at 1 foot intervals from the ground surface to the groundwater table (or 5 feet) in each excavation areas. . Results for soil samples will be provided within 72 hours of collection. If PCB concentrations exceed the RAO of 1 mg/kg total PCBs, additional soil will be excavated in 1-foot increments, and the base will be resampled as described above. This process will continue until the PCB concentrations are below the RAO or the water table is encountered or to meet TSCA criteria below the water table, if possible.
- CPAH confirmation sampling: If evidence of oily material is encountered during confirmation sampling, additional soil samples will be collected and analyzed for CPAHs.
- VOC confirmation sampling: If evidence of soil exhibiting characteristics of VOC contamination (strong odor or elevated PID readings) is noted during confirmation sampling, additional soil samples will be collected and analyzed for VOCs.
- Concrete: Concrete samples will be collected selecting a representative portion of the concrete removed from Grid PP-33 and also from the Trim Building Slab. The concrete will be placed on a hard surface and pulverized using a pre-cleaned steel hammer or weight. The pulverized samples will be placed in a container and shipped to the laboratory for analysis.
- Concrete: Concrete core samples will be obtained from the Triax Building slab and analyzed for PCB to determine whether concrete meets the RAO of 1 mg/kg.

In addition, clean soil will be sampled at each identified off-site source for Target Compound List analysis (VOCs, SVOCs, Pesticides, Cyanide, Metals, and PCBs) and soil pH. Samples will be collected as grab samples from stockpiled soil. A minimum of two soil samples will be collected from each identified source. If greater than 3,000 cubic yards of soil is used, an additional sample will be collected for each 3,000 cubic yards.

### Notes:

CPAH	Carcinogenic polynuclear aromatic hydrocarbon
mg/kg	Milligrams per kilogram
PCB	Polychlorinated biphenyl
PID	Photoionization detector
QC	Quality Control
RA	Remedial action
RAO	Remedial action objective
SVOC	Semivolatile organic compounds
VOCs	Volatile organic compounds

**QAPP WORKSHEET #18**  
**SAMPLING LOCATIONS/IDS, SAMPLE DEPTHS, SAMPLE ANALYSES**  
**AND SAMPLING PROCEDURES TABLE**

<b>Sampling Location/ ID Number</b>	<b>Matrix</b>	<b>Depth (feet bgs)</b>	<b>Analytical Parameters</b>	<b>Sampling SOP Reference</b>
Concrete Removal and Waste Characterization (Grid PP-33 – see Figure 2)	Concrete and soil	NA	PCBs	SOP 005-2, FSP Sections 5.3 and 5.4
Excavation area bases (Trim Building Slab and Triax Building Area – see Figure 3 )	Soil	Varies with excavation area	PCBs	SOP 005-2
Excavation area bases exhibiting oily appearance.	Soil	Varies with excavation	CPAHs	SOP 005-2
Excavation bases with strong odor or evidence of volatile organics	Soil	Varies with excavation	VOCs	SOP 005-2
Clean Fill Sampling	Soil	From Stockpile	VOC, SVOC, Pesticides, PCBs, Metals, cyanide, and pH	SOP 005-2

Notes:

bgs     Below ground surface  
CPAH   Carcinogenic polynuclear aromatic hydrocarbon  
ID      Identification  
NA      Not applicable  
PCB    Polychlorinated biphenyl  
SOP    Standard operating procedure  
SVOC   Semivolatile organic compounds  
VOC    Volatile organic compounds

**QAPP WORKSHEET #19**  
**ANALYTICAL METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES TABLE**

<b>Matrix</b>	<b>Analytical Group</b>	<b>Analytical and Preparation Method<sup>1</sup></b>	<b>Containers (number, size, type)</b>	<b>Preservation Requirements (chemical, temperature, etc.)</b>	<b>Maximum Holding Time (preparation/analysis)<sup>2</sup></b>
Soil	PCBs	A-1	One 4-ounce, wide-mouth glass jar with Teflon-lined cap	Cool to 4 °C ± 2 °C immediately after collection	14 days to extraction/40 days to analysis
Concrete	PCBs	A-1	One 12-ounce, wide-mouth glass jar with Teflon-lined cap	Cool to 4 °C ± 2 °C immediately after collection	14 days to extraction/40 days to analysis
Soil	CPAH	A-3	One 4-ounce, wide-mouth glass jar with Teflon-lined cap	Cool to 4 °C ± 2 °C immediately after collection	14 days to extraction/40 days to analysis
Soil	SVOC	A-4	One 4-ounce, wide-mouth glass jar with Teflon-lined cap	Cool to 4 °C ± 2 °C immediately after collection	14 days to extraction/40 days to analysis
Soil	VOC	A-3	Three VOA vials; one pre-preserved with methanol; two pre-preserved with sodium bisulfate	Cool to 4 °C ± 2 °C immediately after collection	14 days to extraction/40 days to analysis
Soil	pH	A-10	One 4-ounce, wide-mouth glass jar with Teflon-lined cap	Cool to 4 °C ± 2 °C immediately after collection	Not specified.
Soil	Metals and CN	A-6, A-7, A-9	One 4-ounce, wide-mouth glass jar with Teflon-lined cap	Cool to 4 °C ± 2 °C immediately after collection	14 days to extraction/180 days to analysis (except 30 days for Mercury, 14 days for CN)
Soil	Pesticides	A-5	One 4-ounce, wide-mouth glass jar with Teflon-lined cap	Cool to 4 °C ± 2 °C immediately after collection	14 days to extraction/40 days to analysis

Notes:

°C Degree Celsius  
 CN Cyanide  
 CPAH Carcinogenic polynuclear aromatic hydrocarbon  
 PCB Polychlorinated biphenyl  
 SVOC Semivolatile organic compounds  
 VOC Volatile organic compounds

<sup>1</sup> Refer to Worksheet #23 for analytical methods

<sup>2</sup> Holding time is applicable from validated time of sample receipt and is measured to time of sample extraction and analysis.

**QAPP WORKSHEET #20**  
**FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE**

Matrix	Analytical Group	Analytical and Preparation SOP Reference <sup>1</sup>	No. of Grids	No. of Samples	No. of Field Duplicates <sup>2</sup>	No. of MS/MSDs <sup>3</sup>	Total No. of Samples to Laboratory
Confirmation Sampling (Soil)	PCBs	A-1	21	5 per grid	11	6	125
Confirmation Sampling (Concrete)	PCBs	A-1	4	1 per grid	1	1	6
Confirmation Sampling (Soil)	CPAHs <sup>4</sup>	A-3	8	1 per grid	1	1	10
Confirmation Sampling (Soil)	VOCs <sup>5</sup>	A-3	8	2 per grid	2	1	19
Characteristic Testing (Concrete)	PCBs	A-1	1	1 per grid	0	0	1
Soil (Clean Fill)	SVOC	A-4	NA	6	1	1	8
Soil (Clean Fill)	VOC	A-3	NA	6	1	1	8
Soil (Clean Fill)	Pesticides	A-5	NA	6	1	1	8
Soil (Clean Fill)	PCBs	A-1	NA	6	1	1	8
Soil (Clean Fill)	Metals (including mercury and cyanide)	A-6, A-7, and A-9	NA	6	1	1	8
Soil (Clean Fill)	Soil pH	A-10	NA	6	1	0	7

Notes:

Sample numbers in this table reflect field QC samples collected during each sampling event.

CPAH Carcinogenic polynuclear aromatic hydrocarbon

PCB Polychlorinated biphenyl

SOP Standard operating procedure

SVOC Semivolatile organic compounds

VOC Volatile organic compounds

1 Analytical and preparation SOPs are listed in Worksheet #23.

2 Field duplicates are collected at a rate of 1 per 10 investigative samples of the same matrix.

3 MS/MSD samples are collected at a rate of 1 per 20 investigative samples of the same matrix.

4 Samples will be collected only if evidence of oily material is encountered during confirmation sampling.

5 Samples will be collected only if evidence of VOCs is encountered during confirmation sampling.



**QAPP WORKSHEET #21**  
**PROJECT SAMPLING SOP REFERENCES TABLE**

<b>Reference Number</b>	<b>Title, Revision, Date and/or Number</b>	<b>Originating Organization</b>	<b>Equipment Type</b>	<b>Modified for Project Work? (Y/N)</b>	<b>Comments</b>
SOP 002-3	General Equipment Decontamination	SulTRAC	Procedural guidance	N	None
SOP 003-3	Organic Vapor Air Monitoring	SulTRAC	PID, isobutylene calibration gas	N	None
SOP 005-2	Soil Sampling	SulTRAC	Mixing bowl, spoon/spatula, trowel, trier	N	None
SOP 024-1	Recording Notes in Field Logbooks	SulTRAC	Procedural guidance	N	None
FSP Sections 5.3 and 5.4	Bulk Concrete Sample Collection	SulTRAC	Core drill, large hammer, chisel, plastic bags, mixing bowls and sampling jar	N	None

Notes:

FSP     Field sampling plan  
PID     Photoionization detector  
SOP     Standard operating procedure

**QAPP WORKSHEET #22**  
**FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION TABLE**

<b>Field Equipment</b>	<b>Calibration Activity</b>	<b>Frequency</b>	<b>Acceptance Criteria</b>	<b>Corrective Action</b>	<b>Responsible Person</b>	<b>SOP Reference</b>	<b>Comments</b>
PID <sup>1,2</sup>	VOC concentration: canister of 100 ppm isobutylene	Daily before first field measurement and after final field measurement	± 5% isobutylene concentration	Repeat calibration; Adjust span valves to correct concentration, if necessary	Field team leader or field team members	SOP 003-3	None

Notes:

PID      Photoionization detector  
ppm      parts per million  
SOP      Standard operating procedure

<sup>1</sup>      The field equipment will be calibrated per manufacturer's instructions.

<sup>2</sup>      Standard gas canisters will be provided by the equipment vendor to calibrate this instrument

**QAPP WORKSHEET #23**  
**ANALYTICAL SOP REFERENCES TABLE**

Reference Number <sup>1</sup>	Title, Revision, Date, and/or Number <sup>2</sup>	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
A-1	Polychlorinated Biphenyls, SW-846 Method 8082A, HN-GC-002 (Oct 2013)	Definitive	PCBs	GC/ECD	Subcontracted Laboratory	No
A-3	Semivolatile Organic Compounds, SW-846 Method 8270D, HN-SMS-001 (Oct 2013)	Definitive	SVOCs	GC/MS	Subcontracted Laboratory	No
A-4	Volatile Organic Compounds, SW-846 Method 8260B, HN-VMS-003 (Apr 2014)	Definitive	VOCs	GC/MS	Subcontracted Laboratory	No
A-5	Organochlorine Pesticides, SW-846 Method 8081A, HN-GC-001 (Sep 2012)	Definitive	Pesticides	GC/ECD	Subcontracted Laboratory	No
A-6	Metals by ICP-MS, SW-846 Method 6020A, HN-MET-008 (Oct 2013)	Definitive	Metals	ICP-MS	Subcontracted Laboratory	No
A-7	Mercury – Solids, SW-846 Method 7471A, HN-MET-006 (Sep 2013)	Definitive	Mercury	CVAA	Subcontracted Laboratory	No
A-9	Cyanide by Flow Injection Analysis, SW-846 Method 9012A, HN-WC-014 (Sep 2013)	Definitive	Cyanide	Spectrometer	Subcontracted Laboratory	No
A-10	pH Measurement, SW-846 Method 9045D, HN-WC-009 (Sep 2013)	Definitive	Soil pH	pH Meter	Subcontracted Laboratory	No

Notes:

CPAH      Carcinogenic polynuclear aromatic hydrocarbon  
CVAA      Cold vapor atomic adsorption  
GC/ECD    Gas chromatography/electron capture detector  
GC/MS    Gas chromatography/mass spectrometry  
HPLC      High performance liquid chromatography  
ICE-AES   Inductively coupled plasma/atomic emission spectrometry  
ICP-MS    Inductively coupled plasma/mass spectrometry  
PCB       Polychlorinated biphenyl  
SVOCs    Semivolatile organic compounds  
VOCs      Volatile organic compounds

1          Reference numbers A-2, A-8, and A-11 were included in the April 2014 draft QAPP but have been deleted because other methods are being used to provide these analyses  
2          Analytical SOP numbers for the subcontracted laboratory (ALS) are listed

**QAPP WORKSHEET #24**  
**ANALYTICAL INSTRUMENT CALIBRATION TABLE**

<b>Instrument</b>	<b>Calibration Procedure</b>	<b>Frequency of Calibration</b>	<b>Acceptance Criteria</b>	<b>Corrective Action (CA)</b>	<b>Person Responsible for CA</b>	<b>SOP Reference<sup>1</sup></b>
GC/ECD	Pesticides: Run five calibration standard solutions and a blank PCBs: Run five calibration standard solutions and a blank	12-hour continuing calibration acceptance criteria	Always, resolution per SOP Initial, CF RSD $\leq$ 20% Continuing, CF %D $\leq$ 15 for opening and $\leq$ 50 for closing	Inspect the system for problems, change the column, bake out the detector, clean the injection port, and take other CAs to achieve the acceptance criteria.	Laboratory Analyst	A-1, A-5
GC/MS	VOCs: Run five calibration standard solutions and a blank SVOCs: Run five calibration standard solutions and a blank	12-hour continuing calibration acceptance criteria	Always, RRF $\geq$ 0.010 or per SOP Initial, RSD $\leq$ 20% or 40%, depending on compound. Continuing, %D $\leq$ 25 or 40 depending on compound	Inspect the system for problems, clean the ion source, change the column, service the purge and trap device, and take CAs to achieve the technical acceptance criteria.	Laboratory Analyst	A-3, A-4
ICP-MS	Daily calibration curve with at least blank and five standard solutions. Curve must have correlation coefficient of at least 0.998.	Each CCV analyzed shall reflect the conditions of analysis of all associated analytical samples (the preceding 10 analytical samples or the preceding analytical samples up to the previous CCV)	Deviation from the initial calibration verification: metals 90-110%	Inspect the system for problems, clean the system, verify operating conditions, and take CAs to achieve the technical acceptance criteria.	Laboratory Analyst	A-6
CVAA	Daily calibration curve with at least blank and three standards solutions. Curve must be linear and have a correlation coefficient of at least 0.995.	Verify calibration curve at the end of each analysis batch and/or after every 10 samples using a continuing calibration blank (CCB) and CCV standard	CCV standard within $\pm$ 10% of its true value and the CCB must not contain target analytes at or above quantitation limit	Inspect the system for problems, clean the system, verify operating conditions, and take CAs to achieve the technical acceptance criteria.	Laboratory Analyst	A-7
Spectrophotometer	Run at least six calibration standard solutions and a blank. Calibration curve must be linear and have a correlation coefficient of at least 0.995.	Daily or once every 24 hours, each time the instrument is set up, or after any calibration failure.	Deviation from the ICV or CCV within 85-115%	Inspect the system for problems, clean the system, verify operating conditions, and take CAs to achieve the technical acceptance criteria.	Laboratory Analyst	A-9

**QAPP WORKSHEET #24 (CONTINUED)**  
**ANALYTICAL INSTRUMENT CALIBRATION TABLE**

<b>Instrument</b>	<b>Calibration Procedure</b>	<b>Frequency of Calibration</b>	<b>Acceptance Criteria</b>	<b>Corrective Action (CA)</b>	<b>Person Responsible for CA</b>	<b>SOP Reference<sup>1</sup></b>
pH Meter	Run daily calibration using pH 4, 7, and 10 buffer solutions	Analyze a CCV after every 10 samples or 2 hours, whichever is more frequent	Slope response within 90 to 105 percent	Recalibrate pH meter with fresh buffer solutions	Laboratory Analyst	A-10

Notes:

%D	Percent difference
CA	Corrective action
CCB	Continuing calibration blank
CCV	Continuing calibration verification
CF	Calibration factor
CVAA	Cold vapor atomic adsorption
GC/ECD	Gas chromatography/electron capture detector
GC/MS	Gas chromatography/mass spectrometry
HPLC	High performance liquid chromatography
ICE-AES	Inductively coupled plasma/atomic emission spectrometry
ICP-MS	Inductively coupled plasma/mass spectrometry
ICV	Initial calibration verification
PCB	Polychlorinated biphenyl
RSD	Relative standard deviation
RRF	Relative response factor
SOP	Standard operating procedure
SVOC	Semivolatile organic compound
VOC	Volatile organic compound

<sup>1</sup> See Worksheet #23 for identification of analytical methods.

**QAPP WORKSHEET #25**  
**ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE**  
**TESTING, AND INSPECTION TABLE**

<b>Instrument/ Equipment</b>	<b>Maintenance Activity</b>	<b>Inspection Activity</b>	<b>Frequency</b>	<b>Acceptance Criteria</b>	<b>Corrective Action (CA)</b>	<b>Responsible Person</b>	<b>SOP Reference<sup>1</sup></b>
GC/ECD	Daily check, calibration verification	Injector syringe, injector septum, injector liner/seal, injector port, guard column, column splitter, analytical column, ion source, detector, traps, and gas supply	Daily before use	See A-1, A-5	Inspect the system for problems, change the column, bake out the detector, and clean the injection port.	Laboratory Analyst	A-1, A-5
GC/MS	Daily check, instrument tune (decafluorotriphenylphosphine)	Injector syringe, injector septum, injector liner/seal, injector port, guard column, column splitter, analytical column, ion source, detector, traps, and gas supply	Daily before use	See A-3, A-4	Inspect the system for problems, clean the ion source, change the column, and service the purge and trap device.	Laboratory Analyst	A-3, A-4
ICP-MS	Daily check, calibration verification	Nebulizer, injection tube, plasma optimization, gas supply, and detector	Daily before use	See A-6	Inspect the system for problems, clean the system, verify operating conditions, and take CAs to achieve the technical acceptance criteria.	Laboratory Analyst	A-6
CVAA	Daily check, calibration verification	Nebulizer, injection tube, flame optimization, gas supply, and detector	Daily before use	See A-7	Inspect the system for problems, clean the system, verify operating conditions, and take CAs to achieve the technical acceptance criteria.	Laboratory Analyst	A-7
Spectrophotometer	Daily check, calibration verification	Check connections, valves/flow rates, temperature settings, and other items specified by instrument manufacturer	Daily before use	See A-9	Inspect the system for problems, clean the system, verify operating conditions, and take CAs to achieve the technical acceptance criteria	Laboratory Analyst	A-9

**QAPP WORKSHEET #25 (CONTINUED)**  
**ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE**  
**TESTING, AND INSPECTION TABLE**

<b>Instrument/ Equipment</b>	<b>Maintenance Activity</b>	<b>Inspection Activity</b>	<b>Frequency</b>	<b>Acceptance Criteria</b>	<b>Corrective Action (CA)</b>	<b>Responsible Person</b>	<b>SOP Reference<sup>1</sup></b>
pH Meter	Daily check, calibration verification	Check connections, cleanliness of electrode, operating temperature, and other items specified in manufacturer's instructions	Daily before use	See A-10	Inspect the system for problems. Clean the system. Verify operating conditions. Recalibrate using fresh buffer solutions.	Laboratory Analyst	A-10

Notes:

CA        Corrective action  
CVAA     Cold vapor atomic adsorption  
GC/ECD   Gas chromatography/electron capture detector  
GC/MS   Gas chromatography/mass spectrometry  
HPLC     High performance liquid chromatography  
ICE-AES   Inductively coupled plasma/atomic emission spectrometry  
ICP-MS   Inductively coupled plasma/mass spectrometry

<sup>1</sup>        See Worksheet #23 for identification of analytical methods.

**QAPP WORKSHEET #26**  
**SAMPLE HANDLING SYSTEM**

<b>SAMPLE COLLECTION, PACKAGING, AND SHIPMENT</b>
Sample Collection (Personnel/Organization): Field sampling personnel/SulTRAC
Sample Packaging (Personnel/Organization): Field sampling personnel/SulTRAC
Coordination of Shipment (Personnel/Organization): Field sampling personnel, analytical coordinator/SulTRAC
Type of Shipment/Carrier: Cooler packed with ice and packing material such as bubble wrap/FedEx or other overnight courier.
<b>SAMPLE RECEIPT AND ANALYSIS</b>
Sample Receipt (Personnel/Organization): Laboratory personnel/ subcontracted laboratory
Sample Custody and Storage (Personnel/Organization): Laboratory personnel/ subcontracted laboratory
Sample Preparation (Personnel/Organization): Laboratory personnel/ subcontracted laboratory
Sample Determinative Analysis (Personnel/Organization): Laboratory personnel/ subcontracted laboratory
<b>SAMPLE ARCHIVING</b>
Field Sample Storage (No. of days from sample collection): See Worksheet # 27
<b>SAMPLE DISPOSAL</b>
Personnel/Organization: Laboratory personnel/ subcontracted laboratory
Number of Days from Analysis: To be determined (or in accordance with individual laboratory SOP)



## **QAPP WORKSHEET #27**

### **SAMPLE CUSTODY REQUIREMENTS**

#### **Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to the laboratory):**

SulTRAC will use the subcontractor laboratory's chain-of-custody (COC) for documentation and reporting the samples.

Chain-of-custody forms will be signed in ink by the samplers and the individual relinquishing custody. SulTRAC will then follow the sample packaging and shipment procedures summarized below to ensure that samples arrive at the laboratory with the chain of custody intact.

- 1- Immediately after sample collection, sample containers will be labeled with the appropriate identifiers. Clear tape will be placed over the sample container's labels to prevent smearing.
- 2- The samples will be placed in Ziploc plastic bags and then in a cooler containing double-sealed bags of ice and maintained at 4 degrees Celsius (°C). The cooler will remain in a secured area or in view of the sampler until it is properly sealed for shipment to the laboratory.
- 3- Prior to shipping, the chain-of-custody forms, airbills, and all other relevant documents will be completed. Chain-of-custody forms will be sealed in plastic bags and taped to the inside of the cooler lid. Cushioning material, such as bubble-wrap, will be placed in the cooler.
- 4- The shipping cooler will then be sealed with tape and custody seals in a manner that will indicate whether the cooler was opened. The preferred procedure includes placement of custody seals at diagonally opposite corners of the cooler. The custody seals will be covered with clear plastic tape or strapping tape.

The field sampler is personally responsible for the care and custody of the samples until they are transferred to other personnel or properly dispatched to an overnight carrier or directly to a laboratory. When transferring possession of the samples, the individuals relinquishing and receiving the samples sign, date, and note the time of transfer on the chain-of-custody form. Commercial carriers are not required to sign off on the chain-of-custody form as long as the form is sealed inside the sample cooler and the custody seals remain intact.

**QAPP WORKSHEET #27 (CONTINUED)**  
**SAMPLE CUSTODY REQUIREMENTS**

**Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):**

The laboratory sample custodian will receive all incoming samples and indicate receipt by signing the accompanying custody forms and retaining copies of the signed forms as permanent records. The laboratory sample custodian will record all pertinent information concerning the sample, including the persons delivering and receiving the sample, the date and time received, the method by which the sample was transmitted to the laboratory, sample condition at the time of receipt (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample identification number, and any unique laboratory identification number associated with the sample.

The laboratory will provide a secure storage area, restricted to authorized personnel, for all samples. Only the custodian can distribute samples to laboratory personnel authorized to conduct the required analyses. Laboratory analytical personnel are responsible for the care and custody of the sample upon receipt.

At the completion of sample analysis, any unused portion of the sample, together with all identifying labels, will be returned to the custodian. The returned tagged sample will be retained in secure storage until the custodian receives permission to dispose of the sample. Sample disposal will occur only on the order of the laboratory project manager in consultation with EPA or SulTRAC, or when it is certain that the information is no longer required or the samples have deteriorated. Likewise, laboratory records will be maintained until the information is no longer required and final disposition is ordered by the laboratory project manager in consultation with EPA or SulTRAC.

**Sample Identification Procedures:**

Sample identification will be as described in Section 8.2 of the FSP (SulTRAC 2013a). Before or during the sampling event, SulTRAC field personnel will enter information regarding the site, project, sampling team, analysis, location, matrix, collection time and date, and sample and tag numbers.

Notes:

°C	Degree Celsius
COC	Chain of custody
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan

**QAPP WORKSHEET #28**  
**QC SAMPLES TABLE**

<b>Matrix</b>	Soil, Concrete
<b>Analytical Group</b>	PCBs
<b>Concentration Level</b>	NA
<b>Sampling SOP</b>	SOP 005-2, FSP Sections 5.3 and 5.4
<b>Analytical Method/ SOP Reference</b>	A-1
<b>Sampler's Name/ Organization</b>	TBD/SulTRAC
<b>Analytical Organization</b>	Subcontracted Laboratory
<b>No. of Sampling Locations</b>	See Worksheet #18

<b>QC Sample</b>	<b>Frequency/ Number</b>	<b>Corrective Action (CA)</b>	<b>Person(s) Responsible for CA</b>	<b>DQI</b>	<b>Measurement Performance Criteria</b>
Method Blank	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias-Contamination	No target compounds > QL
MS/MSD	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Surrogate Spike	All samples	Reanalyze sample. If upon reanalysis, the surrogate meets criteria, report reanalysis results. If upon reanalysis, the surrogate does not meet criteria, the results are reported in the narrative.	Laboratory Analyst	Accuracy	30-150 %R

**QAPP WORKSHEET #28 (CONTINUED)**  
**QC SAMPLES TABLE**

<b>Matrix</b>	Soil				
<b>Analytical Group</b>	CPAHs and SVOCs				
<b>Concentration Level</b>	NA				
<b>Sampling SOP</b>	SOP 005-2, FSP Sections 5.3 and 5.4				
<b>Analytical Method/ SOP Reference</b>	A-3				
<b>Sampler's Name/ Organization</b>	TBD/SulTRAC				
<b>Analytical Organization</b>	Subcontracted Laboratory				
<b>No. of Sampling Locations</b>	See Worksheet #18				
<b>QC Sample</b>	<b>Frequency/ Number</b>	<b>Corrective Action (CA)</b>	<b>Person(s) Responsible for CA</b>	<b>DQI</b>	<b>Measurement Performance Criteria</b>
Method Blank	1 per extraction batch of 20 samples maximum	Correct problem, then re-prepare and analyze method blank and all samples processed with the contaminated blank.	Laboratory Analyst	Accuracy/Bias-Contamination	All analytes < Reporting limit
Internal Standards	Every sample, spiked sample, standard, and method blank	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning	Laboratory Analyst	Precision	Area within – 50% to +100% of IC midpoint std.
Surrogates	Every sample, spiked sample, standard, and method blank	Re-extract and reanalyze sample.	Laboratory Analyst	Accuracy/Bias	%R as presented in Worksheet #12.

**QAPP WORKSHEET #28 (CONTINUED)**  
**QC SAMPLES TABLE**

<b>Matrix</b>	Soil
<b>Analytical Group</b>	VOCs
<b>Concentration Level</b>	Low
<b>Sampling SOP</b>	SOP 005-2
<b>Analytical Method/ SOP Reference</b>	A-4
<b>Sampler's Name/ Organization</b>	TBD/SulTRAC
<b>Analytical Organization</b>	Subcontracted Laboratory
<b>No. of Sampling Locations</b>	See Worksheet #18

<b>QC Sample</b>	<b>Frequency/ Number</b>	<b>Corrective Action (CA)</b>	<b>Person(s) Responsible for CA</b>	<b>DQI</b>	<b>Measurement Performance Criteria</b>
Method blank	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
MS/MSD	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Deuterated monitoring compounds (or surrogates)	All samples	Reanalyze sample. If on reanalysis, the monitoring compound meets criteria, report reanalysis results. If upon reanalysis, the monitoring compound does not meet criteria, the results are reported in the narrative.	Laboratory Analyst	Accuracy	%R as presented in Worksheet 12

**QAPP WORKSHEET #28 (CONTINUED)**  
**QC SAMPLES TABLE**

<b>Matrix</b>	Soil
<b>Analytical Group</b>	SVOCs
<b>Concentration Level</b>	Low
<b>Sampling SOP</b>	SOP 005-2
<b>Analytical Method/ SOP Reference</b>	A-3
<b>Sampler's Name/ Organization</b>	TBD/SulTRAC
<b>Analytical Organization</b>	Subcontracted Laboratory
<b>No. of Sampling Locations</b>	See Worksheet #18

<b>QC Sample</b>	<b>Frequency/ Number</b>	<b>Corrective Action (CA)</b>	<b>Person(s) Responsible for CA</b>	<b>DQI</b>	<b>Measurement Performance Criteria</b>
Method blank	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
MS/MSD	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Deuterated monitoring compounds (or surrogates)	All samples	Reanalyze sample. If on reanalysis, the monitoring compound meets criteria, report reanalysis results. If upon reanalysis, the monitoring compound does not meet criteria, the results are reported in the narrative.	Laboratory Analyst	Accuracy	%R as presented in Worksheet 12

**QAPP WORKSHEET #28 (CONTINUED)**  
**QC SAMPLES TABLE**

Matrix	Soil
Analytical Group	Pesticides
Concentration Level	NA
Sampling SOP	SOP 005-2
Analytical Method/ SOP Reference	A-5
Sampler's Name/ Organization	TBD/SulTRAC
Analytical Organization	Subcontracted Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	Frequency/ Number	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method blank	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
MS/MSD	1 per extraction batch, 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Laboratory control sample	1 per extraction batch, 20 samples maximum	Check calculations and LCS solutions, and instrument performance. Recalibrate the instrument if necessary or take other corrective actions to meet LCS recovery criteria.	Laboratory Analyst	Accuracy	%R as presented in Worksheet 12
Surrogate spike	All samples	Reanalyze sample. If on reanalysis, the monitoring compound meets criteria, report reanalysis results. If upon reanalysis, the monitoring compound does not meet criteria, the results are reported in the narrative.	Laboratory Analyst	Accuracy	%R as presented in Worksheet 12

**QAPP WORKSHEET #28 (CONTINUED)**  
**QC SAMPLES TABLE**

<b>Matrix</b>	Soil				
<b>Analytical Group</b>	Metals (including mercury, selenium, and Cyanide)				
<b>Concentration Level</b>	NA				
<b>Sampling SOP</b>	SOP 005-2				
<b>Analytical Method/ SOP Reference</b>	A-6, A-7, and A-9				
<b>Sampler's Name/ Organization</b>	TBD/SulTRAC				
<b>Analytical Organization</b>	Subcontracted Laboratory				
<b>No. of Sampling Locations</b>	See Worksheet #18				
<b>QC Sample</b>	<b>Frequency/ Number</b>	<b>Corrective Action (CA)</b>	<b>Person(s) Responsible for CA</b>	<b>DQI</b>	<b>Measurement Performance Criteria</b>
Method Blank	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Sensitivity/ Contamination	No target compounds > QL
MS	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy/Bias	75-125 %R
Laboratory Duplicate	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Precision	<20% RPD



**QAPP WORKSHEET #28 (CONTINUED)**  
**QC SAMPLES TABLE**

<b>Matrix</b>	Soil				
<b>Analytical Group</b>	pH				
<b>Concentration Level</b>	NA				
<b>Sampling SOP</b>	SOP 005-2				
<b>Analytical Method/ SOP Reference</b>	A-10				
<b>Sampler's Name/ Organization</b>	TBD/SulTRAC				
<b>Analytical Organization</b>	Subcontracted Laboratory				
<b>No. of Sampling Locations</b>	See Worksheet #18				
<b>QC Sample</b>	<b>Frequency/ Number</b>	<b>Corrective Action (CA)</b>	<b>Person(s) Responsible for CA</b>	<b>DQI</b>	<b>Measurement Performance Criteria</b>
Laboratory duplicate	1 per extraction batch, 10 samples maximum	If sufficient volume is available, recalibrate pH meter and reanalyze samples.	Laboratory analyst	Accuracy/Bias	< 20% RPD

Notes:

%R      Percentage recovery  
CPAH    Carcinogenic polynuclear aromatic hydrocarbon  
CA       Corrective Action  
DQI      Data quality indicator  
GC       Gas Chromatography  
IC        Initial calibration  
MS       Matrix spike  
MSD     Matrix spike duplicate  
NA       Not applicable  
PCB      Polychlorinated biphenyl  
QL       Quantitation limit  
RPD      Relative percent difference  
SVOC    Semivolatile organic compound  
TBD      To be determined  
VOC      Volatile organic compound

**QAPP WORKSHEET #29**  
**PROJECT DOCUMENTS AND RECORDS TABLE**

<b>Document</b>	<b>Where Maintained</b>
Field notes/logbook	Project file (field data), SulTRAC offices
Chain of custody forms	Project file (laboratory data), SulTRAC offices
Laboratory raw data package	Project file for subcontractor laboratory data
Laboratory equipment calibration logs	Project file for subcontractor laboratory data
Validated data	Project file (laboratory data), SulTRAC offices

**QAPP WORKSHEET #30**  
**ANALYTICAL SERVICES TABLE**

<b>Matrix</b>	<b>Analytical Group</b>	<b>Concentration Level</b>	<b>Sampling Location/ID Number</b>	<b>Analytical SOP</b>	<b>Data Package Turnaround Time</b>	<b>Laboratory/Organization (Name and Address, Contact Person, and Telephone Number)</b>	<b>Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)</b>
Soil and Concrete – Confirmation Samples	PCBs	NA	To be determined	A-1	72 hours	Subcontracted laboratory	Subcontracted laboratory
Concrete – Waste characterization	PCBs	NA	To be determined	A-1	5 days	Subcontracted laboratory	Subcontracted laboratory
Soil – Confirmation Samples	CPAHs	NA	To be determined	A-3	72 hours	Subcontracted laboratory	Subcontracted laboratory
Soil – Confirmation Samples	VOCs	Low	To be determined	A-4	72 hours	Subcontracted laboratory	Subcontracted laboratory
Soil – Clean Fill Sampling	VOC, SVOC, PCBs, Pesticides , Metals, CN, and pH	Low	To be determined	A-1 and A-3 to A-10	5 days	Subcontracted laboratory	Subcontracted laboratory

Notes:

CN Cyanide  
 CPAH Carcinogenic polynuclear aromatic hydrocarbon  
 NA Not applicable  
 PCB Polychlorinated biphenyl  
 SVOC Semivolatile organic compounds  
 SOP Standard operating procedure  
 VOC Volatile organic compounds

**QAPP WORKSHEET #31**  
**PLANNED PROJECT ASSESSMENTS TABLE**

<b>Assessment Type</b>	<b>Frequency</b>	<b>Internal or External</b>	<b>Organization Performing Assessment</b>	<b>Person(s) Responsible for Performing Assessment (Title and Organization)</b>	<b>Person(s) Responsible for Responding to Assessment Findings (Title and Organization)</b>	<b>Person(s) Responsible for Identifying and Implementing CAs (Title and Organization)</b>	<b>Person(s) Responsible for Monitoring Effectiveness of CAs (Title and Organization)</b>
No assessments planned	NA	NA	NA	NA	NA	NA	NA

Notes:

CA Corrective action

NA Note applicable

**QAPP WORKSHEET #32**  
**ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES**

<b>Assessment Type</b>	<b>Nature of Deficiencies Documentation</b>	<b>Individual(s) Notified of Findings (Name, Title, Organization)</b>	<b>Timeframe of Notification</b>	<b>Nature of CA Response Documentation</b>	<b>Individual(s) Receiving CA Response (Name, Title, Organization)</b>	<b>Timeframe for Response</b>
No assessments planned	NA	NA	NA	NA	NA	NA

Notes:

CA Corrective action

NA Not applicable

**QAPP WORKSHEET #33**  
**QA MANAGEMENT REPORTS TABLE**

<b>Type of Report</b>	<b>Frequency (daily, weekly, monthly, quarterly, annually, etc.)</b>	<b>Projected Delivery Date(s)</b>	<b>Person(s) Responsible for Report Preparation (Name, Title, Organization)</b>	<b>Report Recipient(s) (Title and Organization)</b>
Data Validation Report	Once for field sampling	45 days after receipt of all analytical results from laboratory	Tom Hahne, SulTRAC, Project Manager	Tim Drexler, WAM, EPA Region 5
Remedial Action Report	At project completion	30 days after final inspection	Tom Hahne, SulTRAC, Project Manager	Tim Drexler, WAM, EPA Region 5

Notes:

EPA                      US Environmental protection agency  
WAM                     Work assignment manager

**QAPP WORKSHEET #34**  
**VERIFICATION (STEP I) PROCESS TABLE**

<b>Verification Input</b>	<b>Description</b>	<b>Internal/ External</b>	<b>Responsible for Verification (Name, Organization)</b>
Chain-of-custody forms	Chain-of-custody forms will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the chain-of-custody form should be initialed by the reviewer, a copy of the chain-of-custody form should be retained in the project file, and the original and remaining copies should be taped inside the cooler for shipment.	Internal	Resident Inspector, SulTRAC
Field notes/ logbook	Field notes will be reviewed internally and placed in the project file. A copy of the field notes may be attached to the final report.	Internal	Project manager, SulTRAC
Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	Internal	Subcontracted laboratory
	All received data packages will be verified externally in accordance with the data validation procedures specified in Worksheet #35.	External	Analytical coordinator, SulTRAC

**QAPP WORKSHEET #35**  
**VALIDATION (STEPS IIA AND IIB) PROCESS TABLE**

<b>Step IIA/IIB</b>	<b>Validation Input</b>	<b>Description</b>	<b>Responsible for Validation (Name, Organization)</b>
IIa	Chain of custody	Examine traceability of samples from sample collection to sample analysis	SulTRAC Analytical Coordinator
IIa	Holding time	Confirm that holding time requirements are met	Subcontracted laboratory chemist, SulTRAC chemist
IIa	Instrument calibration	Confirm that instrument calibration requirements are met	Subcontracted laboratory chemist, SulTRAC chemist
IIa	Analytical method	Confirm that analytical methods specified in QAPP have been used	Subcontracted laboratory chemist, SulTRAC chemist
IIB	Performance criteria	Confirm that QC samples meet specified performance criteria; document any deviations in data validation report	Subcontracted laboratory chemist, SulTRAC chemist

Notes:

QAPP            Quality Assurance Project Plan  
QC                Quality control



**QAPP WORKSHEET #36**  
**VALIDATION (STEPS IIA AND IIB) SUMMARY TABLE**

<b>Step IIA/IIB</b>	<b>Matrix</b>	<b>Analytical Group</b>	<b>Concentration Level</b>	<b>Validation Criteria</b>	<b>Data Validator (Title and Organization)</b>
IIa	Soil/Concrete	PCBs	NA	Method requirements <sup>1</sup>	SulTRAC chemist
IIa	Soil	CPAHs	NA	Method requirements <sup>1</sup>	SulTRAC chemist
IIa	Soil	VOCs, SVOC, Metals, Pesticides, PCBs, CN, and pH	NA	Method requirements <sup>1</sup>	SulTRAC chemist

Notes:

CN           Cyanide  
CPAH       Carcinogenic polynuclear aromatic hydrocarbon  
NA          Not available  
PCB        Polychlorinated biphenyl  
SVOC       Semivolatile organic compounds  
VOC        Volatile organic compounds

<sup>1</sup>            Method requirements are listed in QAPP Worksheet #12.

## QAPP WORKSHEET #37 USABILITY ASSESSMENT

**Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:** A team of SulTRAC personnel will perform the data usability assessment. SulTRAC's project manager will be responsible for information in the usability assessment. The project manager will also be responsible for assigning work to the individuals who will be supporting the data usability assessment. Note that the data usability assessment will be conducted on validated data. The results of the data usability assessment will be presented in the final project report.

**Precision** – Results of laboratory duplicates will be presented separately in tabular format. For each duplicate pair, the relative percent difference (RPD) will be calculated for each analyte whose original and duplicate values are both greater than or equal to the quantitation limit (QL). The RPDs will be checked against the measurement performance criteria presented in Worksheet #12. The RPDs exceeding criteria will be identified in the tables. A discussion will follow summarizing the laboratory precision results. Any conclusions about the precision of the analyses will be drawn, and any limitations on the use of the data will be described.

**Accuracy/Bias** – Results for laboratory method blanks and instrument blanks will be presented separately in tabular format for each analysis. Similarly, the recovery results for spiked analytes in each analysis will be evaluated. The results for each analyte will be checked against the measurement performance criteria presented in Worksheet #12. Results for analytes that exceed criteria will be identified in the tables. A discussion will follow summarizing the laboratory accuracy/bias results. Any conclusions about the accuracy/bias of the analyses based on contamination will be drawn, and any limitations on the use of the data will be described.

**Sensitivity** – Results for all laboratory-fortified blanks will be presented separately in tabular format for each analysis. The results for each analyte will be checked against the measurement performance criteria presented in Worksheet #12 and cross-checked against the QLs presented in Worksheet #15. Results for analytes that exceed criteria will be identified on the tables. A discussion will follow summarizing the laboratory sensitivity results. Any conclusions about the sensitivity of the analyses will be drawn, and any limitations on the use of the data will be described.

**Representativeness** – The large numbers of samples collected are considered representative of site conditions, as long as completeness criteria in Worksheet #12 are met.

**Comparability** – The results of this study will be used as a benchmark for determining comparability for data collected during any potential future sampling events using the same or similar sampling and analytical SOPs. In addition, the results may be compared with previously collected data.

**Completeness** – A completeness check will be performed on all data generated. Completeness criteria are presented in Worksheet #12. For each analyte and matrix, completeness will be calculated as the number of data points that meet the measurement performance criteria for precision, accuracy/bias, and sensitivity, divided by the total number of data points. A discussion will follow summarizing the calculation of data completeness. This discussion will also note the differences, if any, between the planned sample collection (number and location) and the actual sample collection. Any conclusions about the completeness of the data will be drawn, and any limitations on the use of the data will be described.

**QAPP WORKSHEET #37 (CONTINUED)**  
**USABILITY ASSESSMENT**

**Describe the evaluative procedures used to assess overall measurement error associated with the project:** Not applicable (NA)

**Identify the personnel responsible for performing the usability assessment:** SulTRAC's analytical coordinator will review analytical data, and data validation results for subcontracted laboratory to assess usability of the data. SulTRAC's project manager will review QC results for samples and assess the overall usability of the data set in close consultation with the EPA Work Assignment Manager (WAM).

**Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:** The usability assessment will be documented in the final data validation report, which will be generated 45 days after the last analytical results are received.

Notes:

EPA	U.S. Environmental Protection Agency
NA	Not applicable
QL	Quantitation limit
QC	Quality control
RPD	Relative percent difference
SOP	Standard operating procedure
WAM	Work assignment manager

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## **FIGURES**

(Three Pages)